PROTECTION OF THE WATERS OF THE GREAT LAKES

FINAL REPORT TO THE GOVERNMENTS OF CANADA AND THE UNITED STATES

FEBRUARY 22, 2000

International Joint Commission

Commission mixte internationale

CANADIAN SECTION
234 Laurier Avenue West, 22nd floor
Ottawa, Ontario
Canada K1P 6K6
Telephone: (613) 995-2984
Fax: (613) 993-5583
E-mail: Commission@ottawa.ijc.org

UNITED STATES SECTION
1250 23rd Street, NW, Suite 100
Washington, D.C.
U.S.A. 20440
Telephone: (202) 736-9000
Fax: (202) 736-9015
E-mail: Commission@washington.ijc.org

GREAT LAKES REGIONAL OFFICE
100 Ouellette Avenue, 8th floor
Windsor, Ontario
Canada N9A 6T3
Telephone: (519) 257-6700
Fax: (519) 257-6740
E-mail: Commission@windsor.ijc.org

or

P.O. Box 32869
Detroit, Michigan
U.S.A. 48232-2869
Telephone: (313) 226-2170

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February 22, 2000

Honorable Madeleine Albright
Secretary of State
2201 C St., NW
Washington, DC 20520

The Honourable Lloyd Axworthy, P.C., M.P
Minister of Foreign Affairs
125 Sussex Drive
Ottawa, Ontario K1A 0G2

Dear Secretary Albright and Minister Axworthy:

We have the honor to transmit herewith the Final Report of the International Joint Commission (Commission) addressing the protection of the waters of the Great Lakes. This Report was requested by the Governments of Canada and the United States in the Reference of February 10, 1999, concerning the use of waters along the common border and follows up the Commission's Interim Report of August 10, 1999.

As requested in the Reference, the Report also includes recommendations as to additional work that might be undertaken by the Commission to better understand the implications of consumption, diversions and removals of water from other boundary waters , waters of transboundary basins and groundwater of shared aquifers.

The Commission plans to release the Report to the public on March 15, 2000.

We invite the governments' comments on the report and their guidance on continuation of work in other areas.

Gerald E. Galloway
Secretary
United States Section

Murray Clamen
Secretary
Canadian Section

1250 23rd Street, NW, Suite 100
Washington, D.C.
U.S.A. 20440

234 Laurier Avenue West, 22nd floor
Ottawa, Ontario
Canada K1P 6K6

103-00125/

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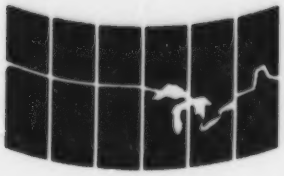

International Joint Commission

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Commissioners

L. H. Legault, Chairman
C. Francis Murphy
Robert Gourd

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Alice Chamberlin

Preface

This is the Final Report of the International Joint Commission to the governments of the United States and Canada concerning protection of the waters of the Great Lakes. It is submitted in response to a February 10, 1999 Reference from the governments to undertake a study of such protection.

This Final Report incorporates and where appropriate updates the Commission's Interim Report of August 10, 1999. It also extends and, in some cases, modifies the conclusions reached and recommendations made in the Interim Report.

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Introduction

Water is an important and often emotional issue throughout North America. Along the U.S.–Canadian border there have been many controversial issues involving boundary and transboundary water resources, and there also have been many opportunities for cooperative ventures, projects, and other efforts to make life considerably better for the citizens of both countries. The history of U.S.–Canadian relations is filled with examples of cooperative efforts in navigation, hydropower, agriculture, and fisheries and of significant improvements in water quality.

Diverting water from the Great Lakes has been an issue of interest and at times controversy between the United States and Canada. This issue, dating back to the 1800s, has been investigated by the International Joint Commission most recently in the mid-1980s. In 1996, the Commission advised both national governments that the subject of diversion and consumptive use of Great Lakes waters needed to be addressed more comprehensively than it had been to date.

In the light of recent proposals to export water from the Great Lakes and other areas of the United States and Canada, the governments decided to refer the issue of water use along the border to the Commission. In a letter of February 10, 1999 (the "Reference"; see Appendix 1), the governments—after noting that the number of proposals to use, divert, and remove greater amounts of water that flow along or across the boundary is increasing—stated that they were concerned that current management principles and conservation measures may be inadequate to ensure the future sustainable use of shared waters. Within this context, the governments requested the Commission to examine, report upon, and provide recommendations on the following matters that may affect levels and flows of waters within the boundary or transboundary basins and shared aquifers:

- existing and potential consumptive uses of water,
- existing and potential diversions of water in and out of the transboundary basins, including withdrawals of water for export,
- the cumulative effects of existing and potential diversions and removals of water, including removals in bulk for export, and
- the current laws and policies as may affect the sustainability of the water resources in boundary and transboundary basins.

The Reference instructed the Commission, in preparing its recommendations, to consider in general terms such matters as potential effects on the environment and other interests of diversions and consumptive uses and, where appropriate, the implications of climatological trends and conditions.

The governments requested the Commission to give first priority to an examination of the Great Lakes Basin, focusing on the potential effects of bulk water removal, including removals for export, and to provide interim recommendations for the protection of the waters of the Great Lakes. The governments asked that the interim recommendations covering the Great Lakes be

submitted within six months and that a final report be submitted six months later. The Commission was asked to include in its final report advice on additional work that may be required to better understand the implications of consumption, diversion, and removal of water from boundary and transboundary basins and from shared aquifers elsewhere along the boundary.

In this report, "Great Lakes Basin" refers to the Great Lakes, their connecting channels, and the international section of the St. Lawrence River, together with their tributaries, and it also includes the reach of the St. Lawrence River immediately downstream from the international section of the river to the end of Lake St. Peter, excluding the tributaries of this downstream reach (Figure 1). This is the same area the Commission addressed in its 1985 report, Great Lakes Diversions and Consumptive Uses.

Immediately after receiving the Reference, the Commission established a binational, interdisciplinary study team to carry out the required investigations. An equal number of members from each country were appointed to the team. They were directed to work in the spirit of consensus in their personal and professional capacities and not as representatives of their countries or organizations. Members of the study team and IJC study participants are listed in Appendix 2.

In August 1999, the Commission submitted to the governments its Interim Report. The Commission recommended that, pending submission of its Final Report under the Reference, federal, state, and provincial governments should not authorize or permit any new bulk sales or removals of surface water or groundwater from the Great Lakes Basin and should continue to exercise caution with regard to consumptive use of these waters. The Commission also offered other recommendations and indicated it would discuss the recommendations with the governments and the public.

The Commission has carried out a broad public-consultation process and has made information related to work on this Reference as widely available as practicable. A section on the International Joint Commission web site (www.ijc.org) was created to disseminate information and to encourage public discussion during the study period. Eight public hearings were held throughout the Great Lakes Basin in both countries in the latter half of March

Figure 1: The Great Lakes Basin.

1999, and 12 additional hearings were held in September and October (Appendix 3). In addition to over 300 presentations made at these hearings, the Commission received hundreds of other submissions in writing and by e-mail, primarily from governments, interest groups, and individuals. The Commission also consulted with federal, provincial, and state governments and regional and other relevant sources, including a selection of experts convened at a special workshop at the end of March 1999 and another workshop in September 1999 (Appendix 4).

The majority of presentations from the public supported the Commission's Interim Report but wanted the recommendations to be strengthened to provide greater protection for the waters of the Great Lakes Basin. There was general opposition to all forms of bulk removals, although some presenters acknowledged the possibility of exports to meet humanitarian needs. Many presenters believed that the Interim Report understated the pressure that may arise in the future for removal of water from the Great Lakes Basin. Many advocated adopting a precautionary approach to removals, particularly in the light of future uncertainties produced by, among other things, the possible impacts of climate change. The hearings revealed widespread concern about water quality issues, groundwater supplies, and the increasing trend to privatization of water and sewage services. They also demonstrated that there is support for conservation measures in the Basin. Aboriginal Peoples and Indian tribes opposed water exports and were concerned that removals or diversions could affect their treaty rights.

The public hearings and written presentations revealed a profound concern on the part of the public that international trade law could prevent proper protection of the waters of the Great Lakes Basin. This view is not shared by the Canadian and U. S. governments, and it is not supported by the statements and writings of many experts in international trade law who appeared before the Commission. These experts agreed that international trade agreements do not prevent governments from protecting the waters of the Great Lakes Basin. The public, however, remains deeply concerned that international trade law could affect the protection of these waters.

This Final Report is based on information the Commission had before it when it prepared the Interim Report and on additional information the Commission subsequently obtained from a variety of sources, including the 12 public hearings held in September and October 1999. The Commission consulted government officials and experts on climate change, cumulative impacts, and international trade and water law.

There is little change from the Interim Report in Section 2– "The Great Lakes System". Section 3–"Water Uses in the Great Lakes Basin"–provides updated information on consumptive use and removals and addresses concerns expressed at the recent public hearings with respect to the possibility of future major diversions and the subject of privatization.

Section 4–"Cumulative Effects"–reports on the findings of an experts workshop on cumulative impacts (held in Windsor, Ontario, in September 1999) and the study team's report on information gathered with respect to the cumulative effects on the Great Lakes ecosystem of factors affecting water levels and flows. Section 5– "Climate Change"–provides more recent information on climate change assessments.

Section 6–"Groundwater"–expands the discussion of groundwater basins and their divides. Section 7– "Conservation"–expands on the need for conservation in the Basin.

Section 8–"Legal and Policy Considerations"–more fully addresses international trade law and U.S. constitutional law issues and provides new information on domestic legal developments in Canada and the United States.

Section 9 (a new section) proposes a plan, as requested by the governments, for the continuation of this study into the remainder of the boundary region.

The Commission reviewed its conclusions and recommendations in the Interim Report. Most conclusions remain the same, others have been modified, and two have been added. Although the thrust of the final recommendations parallels that of the interim report, some of the recommendations in this report have been revised in the light of the Commission's further consideration of the issues; some new recommendations have also been added.

A glossary of terms used in this report is provided in Appendix 5.

Section 2

The Great Lakes System

The Great Lakes Basin lies within eight states and two provinces and comprises the lakes, connecting channels, tributaries, and groundwater that drain through the international section of the St. Lawrence River. The waters of the Great Lakes Basin are a critical part of the natural and cultural heritage of the region, of Canada and the United States, and of the global community. About 40 million people reside in the Basin itself[1]. Spanning over 1,200 km (750 mi.) from east to west, these freshwater seas have made a vital contribution to the historical settlement, economic prosperity, culture, and quality of life and to the diverse ecosystems of the Basin and surrounding region.

The waters of the Great Lakes have been a fundamental factor in placing the region among the world's leading locations in which to live and do business. Water contributes to the health and well-being of all Basin residents, from its use in the home to uses in manufacturing and industrial activity, in shipping and navigation, in tourism and recreation, in energy production, and in agriculture. The Great Lakes are, however, more than just a resource to be consumed; they are also home to a great diversity of plants, animals, and other biota.

The waters of the Great Lakes are, for the most part, a nonrenewable resource. They are composed of numerous aquifers (groundwater) that have filled with water over the centuries, waters that flow in the tributaries of the Great Lakes, and waters that fill the lakes themselves. Although the total volume in the lakes is vast, on average less than 1 percent of the waters of the Great Lakes is renewed annually by precipitation, surface water runoff, and inflow from groundwater sources[2].

Lake levels are determined by the combined influence of precipitation (the primary source of natural water supply to the Great Lakes), upstream inflows, groundwater, surface water runoff, evaporation, diversions into and out of the system, consumptive use, dredging, and water level regulation. Because of the vast water surface area, water levels of the Great Lakes remain remarkably steady, with a normal fluctuation ranging from 30 to 60 cm (12-24 in.) in a single year.
Climatic conditions control precipitation (and thus groundwater recharge), runoff, and direct supply to the lakes, as well as the rate of evaporation. These are the primary driving factors in determining water levels. With removals and in-Basin consumptive use remaining relatively constant, during dry, hot-weather periods, inflow is decreased and evaporation increased, resulting in lower lake levels and reduced flows. During wet, colder periods, the opposite situation develops: higher levels and increased flows. Between 1918 and 1998, there were several periods of extremely high and extremely low water levels and flows. Exceptionally low levels were experienced in the mid-1920s, mid-1930s, and early 1960s. High levels occurred in 1929-30, 1952, 1973-74, 1985-86, and 1997-98. Studies of water level fluctuations have shown that the Great Lakes can respond relatively quickly to periods of above-average, below-average, or extreme precipitation, water supply, and temperature conditions.

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[1] The Interim Report's figure –more than 33 million– did not include the over 6 million people residing in and around Chicago who use water from the Lake Michigan drainage basin.

[2] The Great Lakes Information Network. "*An Overview of Flows.*" *Great Lakes-St. Lawrence Water Flows.* http://www.great-lakes.net/envt/water/flows.html (16 Feb 2000).

Great Lakes levels and lake level interests are highly sensitive to climatic variability, as illustrated by the impact of high water levels in the early 1950s and mid-1980s and of low water levels in the 1930s and mid-1960s. Significant variability will continue whether or not human-induced climate change is superimposed on natural fluctuations. An example of how quickly water levels can change in response to climatic conditions occurred during 1998-99, when the water levels of Lakes Michigan-Huron dropped 57 cm (22 in.) in 12 months.

Studies have concluded that the hydraulic characteristics of the Great Lakes system are the result of both natural fluctuation and, to a lesser extent, human intervention[3]. Control works that are operated under the authority of the International Joint Commission have been constructed in the St. Marys River at the outlet of Lake Superior and in the St. Lawrence River below the outflow from Lake Ontario. The level of Lake Erie has been increased by obstructions in the Niagara River, including a number of fills on both sides of the river, with a cumulative effect of about 12 cm (4.8 in.). Dredging in the connecting channels has had a relatively significant impact on lake levels, even in comparison to natural fluctuations. Connecting channels and canals that have been dredged to facilitate deep-draft shipping have permanently lowered Lakes Michigan–Huron by approximately 40 cm (15.8 in.). Although dredging in the connecting channels can have a significant effect, its impact is greatest on lakes above the point of dredging, with downstream interests still receiving the total amount of water flowing through the system. Out-of-basin diversions or other removals and consumptive uses, by contrast, reduce water levels both above and below the actual point of withdrawal and also reduce flows in the system.

Diversions have been constructed to bring water into the Great Lakes system from the Albany River system in northern Ontario at Long Lac and Ogoki. They also have been constructed to take water out of the system at Chicago and, to a much lesser extent, through the Erie Canal. At present, more water is diverted into the system than is taken out. A few other diversions on the border of the Basin move water in and out of the Basin and have negligible effect. The volume of diversions out of the Basin, of other removals, and of consumptive uses exceeds the volume of water brought into the Basin by diversions and other artificial means. Water is also diverted around Niagara Falls for hydroelectric power generation, and water is diverted from Lake Erie to Lake Ontario through the Welland Canal.

Groundwater is important to the Great Lakes ecosystem because it provides a reservoir for storing water and for slowly replenishing the Great Lakes through base flow in the tributaries and through direct inflow to the lakes. Groundwater also serves as a source of water for many human communities and provides moisture and sustenance to plants and other biota.

The Great Lakes Basin is home to a diverse range of fish, mammals, birds, and other biota. The interplay between human activity and the natural order of the Lakes is complex and only partially understood. Human activity is altering the biological diversity and the socioeconomic structure of the Great Lakes Basin. Not only has there been some loss of species in the Lakes, but there has also been the introduction and establishment of alien invasive species like the lamprey eel, the zebra mussel, and the goby fish through channels built to foster transportation and electricity. Urbanization and farming have changed the hydrology of the Lakes by reducing wetlands and other natural habitats and by altering the speed at which runoff reaches the lakes[4].

[3] Levels Reference Study Board (1993). *Levels Reference Study, Great Lakes-St. Lawrence River Basin.* Submitted to the International Joint Commission March 31, 1993.

[4] Testimony of Professor Steve Foreman, University of Illinois at Chicago, in a public hearing in Gary, Indiana, on October 19, 1999.

Section 3

Water Uses in the Great Lakes Basin

The Commission has conducted an examination of water use data in the Great Lakes Basin. Water uses are presented in two categories: (1) consumptive uses estimated from water withdrawal data and (2) removals. Close to 90 percent of withdrawals are taken from the lakes themselves, with the remaining 10 percent coming from tributary streams and groundwater sources (Figure 2-A)[5].

In its Interim Report issued in August 1999, the Commission used the most current data that were available at that time for its analysis—1993 data drawn from the Regional Water Use Data Base, maintained by the Great Lakes Commission (GLC) on behalf of the Great Lakes states and provinces[6]. These data did not include consumptive use figures for the Chicago urban area.

Since the Interim Report, the GLC has provided the Commission with more recent water use data[7]. Although most of these data are concentrated in the years 1994-98, not all of the data fall into this time frame[8]. Because the data span several years and the methods of data collection vary from one jurisdiction to another, trend analysis and jurisdictional comparison are difficult. In some instances, there are large differences between the two sets of data in water use by sector presented by some individual jurisdictions; the reasons for these differences are not always clear. The Commission is of the view that analysis of the 1994-98 water use data by sector and jurisdiction is of limited value. It decided to focus instead on the overall aggregate Basin figures for withdrawals and consumptive use, and compared these figures with the equivalent 1993 numbers, including Chicago consumption data.

The Commission also looked at Great Lakes Basin water use data, extracted from national databases compiled by the U.S. Geological Survey (USGS)[9] and Environment Canada (EC)[10]. For its five-year reports, the USGS analyzes state data, adjusts the data to compensate for perceived deficiencies, and produces estimates of actual water use for the year of the report. Environment Canada derives its information from Statistics Canada surveys of major water users in the Basin, not from provincial data. Environment Canada's water use data tend to be lower than data provided by the provinces to the GLC's Regional Water Use Data Base, since provincial data are generated from water license permits as opposed to actual withdrawals. Like the USGS, Environment Canada's treatment of data is viewed as consistent over the years. As with the 1994-98 GLC data,

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5 Because water withdrawn for use in hydroelectric facilities is immediately returned to its source, withdrawal figures used in this report do not include withdrawals for hydroelectric purposes.

6 The interim report data were current from 1978 to 1987 for Michigan and 1992 for Ontario.

7 *"Updated Water Use Information"*—memorandum (with accompanying data sheets) dated November 24, 1999, from Michael Donahue, Executive Director, Great Lakes Commission, to Study Team co-directors J. Hougnon and R. Pentland.

8 The Great Lakes Commission has provided the Commission with more recent data from Illinois (1994), Indiana (1995), Michigan (multiyear back to 1978), Minnesota (1998), New York (1995), Ohio (1998), Pennsylvania (1994), Wisconsin (1994), and Quebec (1994). Ontario's data remain current to 1992.

9 U.S. Geological Survey (1999). *Estimated Use of Water in the United States in 1995*. USGS Survey Circular 1200, USGS, Denver, CO.

10 D. Tate and J. Harris (1999). *Water Demands in the Canadian Section of the Great Lakes Basin, 1972–2021*. Gaia Economic Research Associates, Ottawa.

Table 1: Water Withdrawals and Consumption in the Great Lakes Basin According to Various Databases.

	Withdrawals			Consumption			Consumption
	cms	cfs	mgd	cms	cfs	mgd	Rate
Great Lakes Commission (1993)	2,493	88,060	56,920	121	4,270	2,760	4.6%
Great Lakes Commission (1994-98)	2,415	85,290	55,130	109	3,850	2,490	4.5%
USGS (1995) / Environment Canada (1996)	2,418	85,380	55,190	106	3,740	2,420	4.4%

the Commission concentrated on Basin aggregate numbers for withdrawals and consumptive use, mainly because of the somewhat different water use sector category and classification systems utilized by the two federal agencies.

Table 1 provides data (rounded) for withdrawals and consumptive use calculated from the various databases above. All tables and charts in this final report now reflect data for the Chicago urban area. The data indicate a range for water use in the Great Lakes Basin. The percentage of water consumed is approximately the same for all data sources, ranging from 4.4 percent to 4.6 percent.

Consumptive Use

For consumptive use, the Commission determined that the 1993 data, now updated with the inclusion of full water use data for Chicago, would be the basis for its final report. The Great Lakes Commission stated that the 1993 data were sufficiently comprehensive and consistent across all jurisdictions, were the product of a quality assurance and control process by its committee of water resource managers, and provided the best possible snapshot of water use in the Basin.

In 1993, consumptive use in the Great Lakes Basin was estimated to be 121 cms (4,270 cfs) as compared to a withdrawal of about 2,493 cms (88,060 cfs) (Figure 2-B). The 1993 consumptive use in the Great Lakes Basin can be summarized as follows:

- By country: Canada, 33 percent, and the United States, 67 percent, with per capita consumptive use being approximately equal for the two countries.

- By jurisdiction: Ontario, 27 percent; Michigan, 21 percent; Wisconsin, 20 percent; Indiana, 7 percent; New York, Quebec, and Ohio, 6 percent each; Illinois, 4 percent; Minnesota, 2 percent; and Pennsylvania, less than 1 percent (Figure 2-C).

- By type of water use: irrigation, 29 percent; public water supply, 28 percent; industrial use, 24 percent; fossil fuel thermoelectric and nuclear uses, 6 percent each; self-supplied domestic use 4 percent; and livestock watering, 3 percent (Figure 2-D).

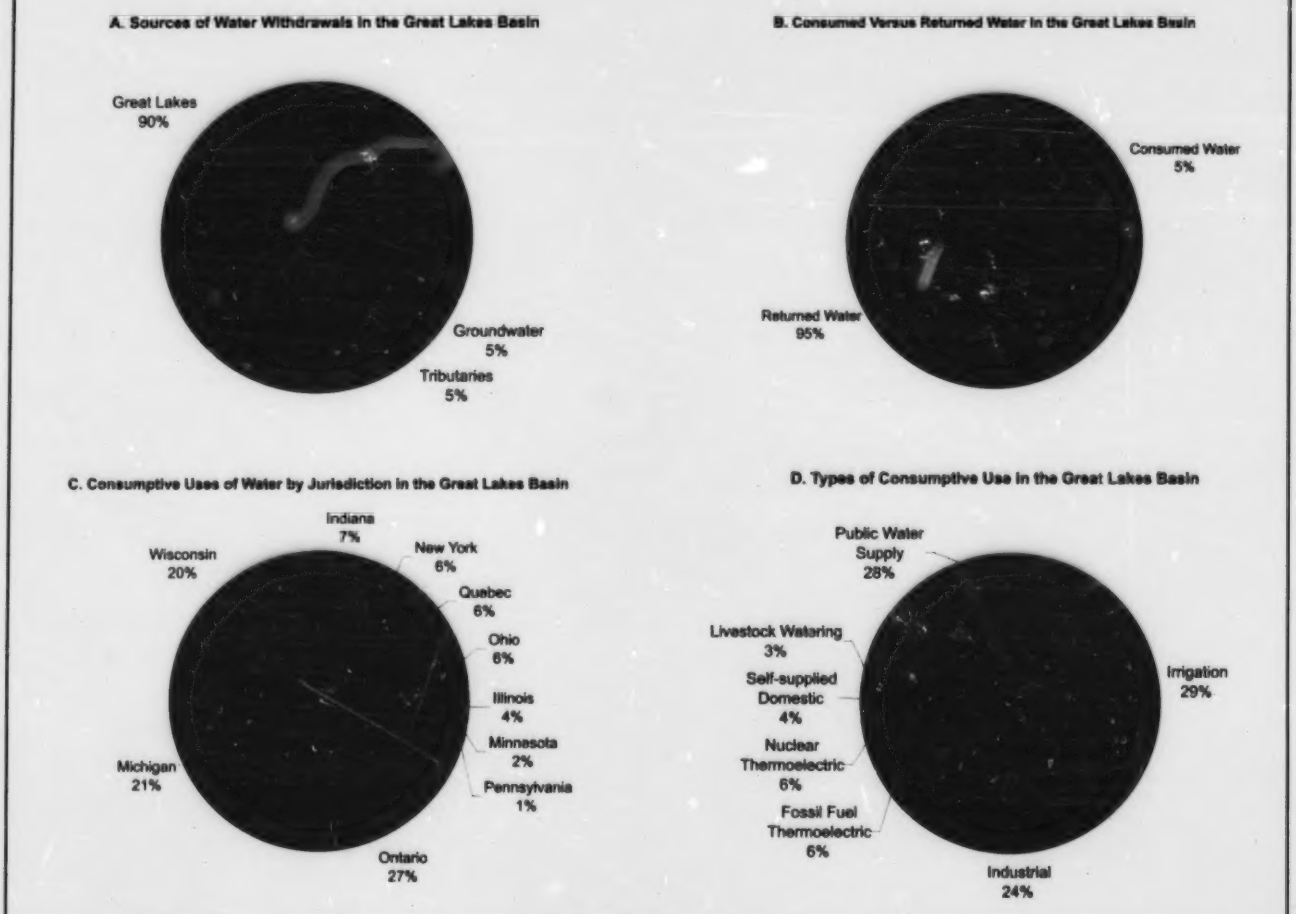
The percentage of withdrawn water that is consumed within the Great Lakes system varies with the type of use to which the water is put. When water is used for irrigation, over 70 percent is consumed[11]. At the other extreme, when water is used for thermoelectric power, less than 1 percent is consumed. The percentage of water lost to the Basin when it is used for public supply and for industrial purposes—other large water-using categories—is of the order of 10 percent for each (Figure 3). As previously indicated the average consumption rate, considering all types of uses, is approximately 5 percent.

Consumptive use data for groundwater are not available for most jurisdictions. Groundwater withdrawal in the Great Lakes Basin is estimated to be generally between 3 percent and 5 percent of the total water withdrawal in the Basin. This figure, however, greatly understates the importance of groundwater to the Basin population. The USGS estimates that over 8 million people on the U.S. side of the border rely on groundwater as their source of drinking water, and groundwater is the most common source of bottled water. The effects of groundwater withdrawal may therefore be of concern on a local or subregional basis, particularly with respect to urban sprawl, even if withdrawals do not have a major impact on the overall water budget of the Basin[12].

11 The state of Michigan believes that a consumptive use rate of approximately 90 percent is a more realistic figure. The 1995 USGS data indicate that the irrigation consumption in the U.S. portion of the Great Lakes Basin is 94 percent.

12 See Section 6 for further information on groundwater. The Commission was not provided with groundwater use data for the Canadian section of the Basin.

Figure 2: Water Use in the Great Lakes Basin.

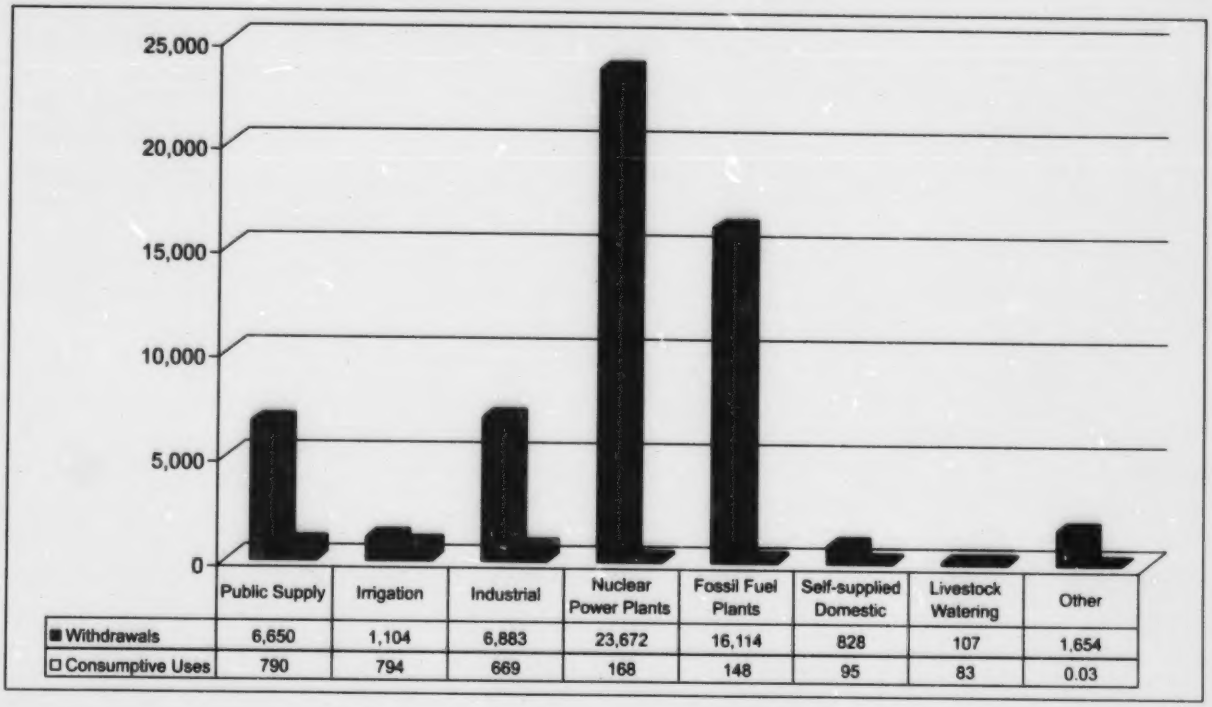


The Commission has developed insights into trends in water use and their impact on potential future water demands. These insights were derived from a simple extension of trends established over the previous decade The variability in existing data complicates not only analysis of past and present trends, but also the task of predicting the future. All predictions are heavily dependent on the assumptions underlying them and on an accurate understanding of the present starting point. Factors such as climate change could encourage the increased use of water for irrigation and other purposes. On the other hand, continued improvement in water demand management as well as in water conservation might help to slow any increase in withdrawals for consumptive use within the Basin. Because population will increase, there is a greater probability of increasing use in the future than there is of decreasing use. Projections presented below extend to 2020. The Commission believes that water use is likely to increase modestly by 2020 and that projections beyond this point should be considered highly speculative.

Thermoelectric Power Use. At thermoelectric power plants, water is used principally for condenser and reactor cooling. In the United States, thermoelectric withdrawals have remained relatively constant since 1985 and are expected to remain near their current levels foı the next few decades. In Canada, modest increases are expected to continue along with population and economic growth.

Industrial and Commercial Use. In the United States, industrial and commercial water use has declined in response to environmental pollution legislation, technological advances, and a change in the industrial mix from heavy metal production to more service-oriented sectors. A similar trend is evident in Ontario, so combined use is expected to gradually decline through 2020.

Figure 3: Withdrawals and consumptive uses in the Great Lakes Basin (in millions of gallons per day).



	Public Supply	Irrigation	Industrial	Nuclear Power Plants	Fossil Fuel Plants	Self-supplied Domestic	Livestock Watering	Other
■ Withdrawals	6,650	1,104	6,883	23,672	16,114	828	107	1,654
□ Consumptive Uses	790	794	669	168	148	95	83	0.03

Domestic and Public Use. In the United States, water use for domestic and public purposes in the Great Lakes Basin generally increased from 1960 to 1995 and is expected to climb gradually through 2020. In Ontario, however, the modest downward trend established in recent years because of water conservation efforts is expected to continue.

Agriculture. In the United States, water use for agriculture in the Great Lakes region increased fairly steadily from 1960 to 1995 and is expected to continue to grow. In Canada, the rate of increase was somewhat greater, so that combined projections indicate a significant increase by 2020. Climate change could increase even further the competitive advantage in agriculture the Basin has as a result of its relative abundance of water.

Total Water Use. There is agreement that water withdrawal will increase in the future, although it is impossible to say with confidence just how much the increase will be[13].

There is, however, no such agreement on consumptive use. For example:

- The USGS and the U.S. Forest Service both estimate that water withdrawals in the U.S. portion of the Great Lakes Basin could rise about 2 percent from 1995 to 2040.
- The USGS forecasts a decline of 2 percent to 3 percent in consumptive use of water in the U.S. section of the Great Lakes by 2020.
- A consultant to the study team developed a trend line for the period 1995-2020 that has consumption rising by 27 percent in the U.S. portion of the Basin, by 19 percent in the Canadian portion of the Basin, and by 25 percent in the whole Basin.
- The same consultant also produced estimates for a "conservation" scenario that projected rises in consumption by 2020 in the U.S. portion of the Basin of 4 percent, in the Canadian section of 1 percent, and in the total Basin of 3 percent.

13 T.C. Brown, U.S. Department of Agriculture, Forest Service, (1999). *Past and Future Freshwater Use in the United States: A Technical Document Supporting the 2000 USDA Forest Service RPA Assessment* ; W.B Solley, USGS, 1999 (unpublished). *Past and Future Freshwater Use in the Great Lakes Water-Resources Region*, USA; Tate and Harris, op cit.

The above figures may represent a range of possibilities. What is clear is that water managers will need to manage the resource carefully.

Removals

Removals are waters that are conveyed outside their basin of origin by any means. The following paragraphs discuss current removals by diversion, other types of removals such as removal by marine tanker, bottled water, or ballast water, and the potential for future diversions and other removals. Some past diversion and removal proposals are summarized in Appendix 6.

Current Diversions. Water diversions into and out of the Great Lakes Basin are summarized in Figure 4 and by the accompanying data in Table 2.

The U.S. Supreme Court has authorized an average removal of 3,200 cfs (91cms) from Lake Michigan into the Mississippi River system through the Chicago Diversion. This is the only major diversion out of the Great Lakes Basin. From 1981 to 1995, the Chicago Diversion, as reported by the Corps of Engineers, has averaged 3,439 cfs (97 cms), which is 239 cfs (6.9 cms) more than the U.S. Supreme Court limit of 3,200 cfs (91 cms). Pursuant to the 1996 Memorandum of Understanding, the state of Illinois has agreed to repay the cumulative flow deficit by the year 2019.

The Long Lac and Ogoki diversions into Lake Superior from the Albany River system in northern Ontario are the only major diversions into the Basin. These two diversions represent 6 percent of the supply to Lake Superior.

At present, more water is diverted into the Great Lakes Basin through the Long Lac and Ogoki diversions than is diverted out of the Basin at Chicago and by several small diversions in the United States. If the Long Lac and Ogoki diversions were not in place, water levels would be 6 cm (2.4 in.) lower in Lake Superior, 11 cm (4.3 in.) lower in Lakes Michigan–Huron, 8 cm (3.1 in.) lower in Lake Erie, and 7 cm (2.8 in.) lower in Lake Ontario[14].

[14] Figures supplied by Study Team, as derived from the Commission's 1985 report, *Great Lakes Diversions and Consumptive Uses.*

Aside from these major diversions, there are also a few small diversions[15]. Three were implemented in the 19th century to facilitate waterborne commerce between the Great Lakes and neighboring drainage basins. These are the Forestport, New York, diversion of water from the Black River tributary of Lake Ontario into the Erie Canal and Hudson River basin; the Portage Canal diverting Wisconsin River water from the Mississippi River system into the Lake Michigan basin; and the Ohio and Erie Canal diverting water from the Ohio River basin into the uyahoga River of the Lake Erie basin. All three are now used primarily for recreational purposes.

In recent years, London, Ontario and Detroit, Michigan have taken water from Lake Huron for municipal purposes, discharging their effluent to Lake St. Clair and the Detroit River, respectively. The Raisin River Conservation Authority in Ontario has, with the approval of the Commission, taken water from the international section of the St. Lawrence River to maintain summer flows in the Raisin River. Ohio has reported very small diversions in Lorain County and the City of Ravenna, both communities whose customers straddle the Lake Erie–Ohio basin divide. The information in this section covers the diversions of which the Commission is aware. There may be others.

Two U.S. communities –Pleasant Prairie, Wisconsin, which lies outside the Basin, and Akron, Ohio, whose water district straddles the Great Lakes Basin divide– have obtained permission under U.S. law (the Water Resources Development Act of 1986) to take water from the Great Lakes on the condition that they return an equivalent volume of water over time to the Basin. In 1988, the Great Lakes governors approved the Pleasant Prairie Diversion and agreed that a like amount of water would be returned to the Lake Michigan Basin by 2005. Although this diversion was below the consultation trigger amount in the Great Lakes Charter, Ontario and Quebec were consulted. Quebec concurred, but Ontario did not. The diversion was implemented. After 2005, the diversion would provide "no net loss" to Lake Michigan. With respect to Akron, the gov-

[15] Claire Farid, John Jackson, and Karen Clark. *The Fate of the Great Lakes: Sustaining or Draining the Sweetwater Seas?* Canadian Environmental Law Association and Great Lakes United, February 10, 1997.

Figure 4: Existing Diversions in the Great Lakes Basin.

Table 2: Existing Diversions in the Great Lakes Basin - Data.

Existing Diversions in the Great Lakes Basin	Operational Date (original project)	Average Annual Flow (cms)	(cfs)
1. Interbasin			
Long Lac (into Lake Superior basin)	1939	45	1,590
Ogoki (into Lake Superior basin)	1943	113	3,990
Chicago (out of Lake Michigan basin)	(1848)1900	91	3,200
Forestport (out of Lake Ontario basin)	1825	1.4	50
Portage Canal (into Lake Michigan basin)	1860	1	40
Ohio & Erie Canal (into Lake Erie basin)	1847	0.3	12
Pleasant Prairie (out of Lake Michigan basin)	1990	0.1	5
Akron (out of and into Lake Erie basin)	1998	0.01	0.5
2. Intrabasin			
Welland Canal	(1829)1932	260	9,200
NY State Barge Canal (Erie Canal)	(1825)1918	20	700
Detroit	1975	4	145
London	1967	3	110
Raisin River	1968	0.7	25
Haldimand	1997	0.1	2

The Chicago Diversion

The Chicago Diversion is the historical descendant of the Illinois & Michigan Canal, which was constructed in the mid-1800s to allow river transportation between the Great Lakes and the Mississippi River. As Chicago grew, the primary purpose of diverting water shifted from navigation to managing sewage and providing a source of potable water for a population suffering from repeated outbreaks of water-borne disease. In 1885, 90,000 people, roughly 12 percent of the population, died when a heavy rainstorm overwhelmed the sewage system and polluted drinking water sources.

The possible impacts of the diversion on the Great Lakes riparian community and downstream interests in both the United States and Canada have been matters of discussion and litigation since the turn of the century[16]. Canada has objected, through diplomatic notes and other communications, to each of the proposals to increase the Chicago diversion. The Commission notes that the U.S. government has been at pains to ensure that decision-makers in the United States are aware of the Canadian government's views and that indeed they have been taken into account. In 1967, the U.S. Supreme Court limited the diversion to 3,200 cfs (91 cms) and subsequently permitted Illinois to average the diversion over a 40-year period. Until recently, the amount of water for the Chicago Diversion has been measured at the end of the Diversion works at Lockport, Illinois, where water is deposited into the Des Plaines River, which empties into the Illinois River. In 1996, the state of Illinois, the other Great Lakes states, and the Department of Justice on behalf of the U.S. federal government entered into a Memorandum of Understanding that, among other things, allows for a change in the Diversion-accounting system. Under the new procedures, water managers will measure the water entering the Diversion at the lakefront Diversion structures. This new arrangement required the parties to agree on an estimate for the amount of stormwater runoff (i.e., rainfall that falls in the Lake Michigan Basin, is captured by the drainage sewers in the Chicago urban area, and never enters Lake Michigan). The parties have agreed that this figure will be 800 cfs (23 cms). The new arrangement also required the parties to agree on an estimate of water consumed in the Chicago urban area and never transferred to the Illinois River. The parties have established this amount as 168 cfs (4.9 cms). Taking these two figures into account, both of which are figures established by negotiation and not from actual measurements, the amount of measured water that the state of Illinois can take directly from Lake Michigan is 2,568 cfs (73 cms)–3,200 cfs (91 cms) minus 800 cfs (23 cms) plus 168 cfs (4.9 cms)

The Long Lac and Ogoki Diversions

The United States agreed to the Long Lac and Ogoki diversions to enable Canada to increase its production of electricity during World War II. Canada has sole use of the water to generate electricity immediately downstream from the diversions, at Niagara, and in the St. Lawrence River in Quebec. It shares the water with the United States at Sault Ste. Marie and in the international section of the St. Lawrence. The two diversions operate under an exchange of diplomatic notes between the United States and Canada dating back to 1940 and under Article III of the Niagara Treaty of 1950 (Appendix 7). The additional water in times of high supply has contributed to problems for riparians living on Lake Superior and other Lakes. In 1952, 1973, and 1985, Canada agreed to U.S. requests to reduce the flow from these diversions to help alleviate problems caused by high lake levels. In future, Canada might also wish to reduce or terminate these diversions for its own reasons. Thus, there can be no assurance that the contribution of Long Lac and Ogoki diversions to the water supplies of the Great Lakes will be continued indefinitely. Reducing or terminating these diversions would adversely affect hydroelectric power and also affect other interests. When high water levels are also occurring in the Albany River watershed, the natural outlet for Long Lac and Ogoki, reducing the diversions may cause flooding in the Albany basin.

[16] In 1905, Missouri filed suit in the U.S. Supreme Court to force Illinois to end the diversion. The Court ruled for Illinois. The Supreme Court first began to limit the Chicago Diversion in 1925 (Stanley A. Changnon and Mary E. Harper, "History of the Chicago Diversion," in *The Lake Michigan Diversion at Chicago and Urban Drought*, edited by Stanley A. Changnon, NOAA Contract 50WCNR306047, Mahomet, Illinois, 1994, pp. 16–38).

ernors approved; Ontario concurred, and Quebec did not object. The state of Ohio has already increased the flow of water into the Cuyahoga River from the Ohio/Portage system to support the Akron Diversion, and there is no loss of water to the Great Lakes from this diversion.

In addition to these diversions in and out of the Great Lakes Basin, the Welland and Erie Canals divert water between subbasins of the Great Lakes and are considered intrabasin diversions[17]. In 1997, another small intrabasin diversion was built from Hamilton to the Haldimand region in Ontario.

Other Removals. Public concern has been focused on the potential movement of freshwater in bulk beyond the Great Lakes Basin by ocean tankers. To date, no contracts are in place, and no regular trade has begun to ship water in bulk from the Great Lakes Basin or from North America as a whole[18]. For almost two decades, however, entrepreneurs have actively pursued foreign markets and have sought approval to export from jurisdictions on both the west and east coasts. When the Interim Report was written, Alaska, Newfoundland, and Quebec were considering proposals to export freshwater in bulk by ocean tankers, although both Newfoundland and Quebec have since moved to prohibit such exports subject to exceptions described in Section 8 of this report.

The Commission has learned that one exporter in Alaska was shipping a small volume of water, 378,500 liters per week (100,000 gallons/week). The Commission understands that orders for Alaskan water have fallen significantly since the beginning of 1999. The water is placed in containers that are barged to Washington state, where the water is bottled. It is then shipped to Alaska, Taiwan, and Korea. Although it seems clear that climate change and continued reports of worldwide water shortages will continue to keep discussion of bulk water shipments alive, the cost of such shipments makes it unlikely that there will be serious efforts to take Great Lakes water to foreign markets, and cost will continue to serve as an impediment to bulk shipments from coastal waters. Thus far, companies in these jurisdictions have captured only small markets for bottled water.

Analysis of the bottled water industry indicates that when intrabasin trade in bottled water is subtracted from the total trade, the Basin imports about 14 times more bottled water than it exports– 141 million liters (37 million gallons) in 1998 imported vs. 10 million liters (2.6 million gallons) exported. At this time, bottled water appears to have no effect on water levels in the Great Lakes Basin as a whole, although there could be local effects in and around the withdrawal sites[19].

Trade in other types of beverages is believed to be of a similar order of magnitude[20]. For example, 272 million liters (72 million gallons) of bottled water were exported in 1998 from all of Canada to the United States. That represented 33 percent of all beverage exports from Canada to the United States that year, compared with 44 percent for beer and 19 percent for soft drinks. Considering the extremely small magnitude of trade in bottled water and other beverages, it would appear both impractical and unnecessary to treat bottled water and other beverages any differently than any other products that either include water or use water in their production processes.

In July 1999, there was a flurry of media interest in the bottled water situation in Ontario. According to media reports, the Ontario government had issued permits authorizing the withdrawal of 18 billion liters (4.8 billion gallons) of water per year for bottling purposes, almost all from groundwater sources. Only about 4 percent of this volume is currently being withdrawn, amounting to a flow of 0.02 cms (0.7 cfs), and Ontario is reviewing whether groundwater supplies are adequate to satisfy the licenses

17 In terms of volume, the Welland Canal, with an average diversion of 261 cms (9,200 cfs) is the largest intrabasin diversion in the Great Lakes Basin. Welland has been estimated to lower the mean levels of Lake Erie by 13.4 cm (5 in.), of Lakes Michigan-Huron by 5.5 cm (2 in.), and of Lake Superior by 1.8 cm (1 in.). *Great Lakes Diversion and Consumptive Uses*, International Joint Commission, 1985.

18 A major impetus for this study was public concern over an application from a firm called NOVA to export water via ship from Lake Superior. At a public hearing, a NOVA representative told the Commission that NOVA had neither conducted a feasibility analysis nor identified any customers for Lake Superior water at the time it sought and obtained a permit from Ontario for the bulk removal of water. Ontario later revoked the permit.

19 Hidell-Eyster International, Hingham, Mass. *Great Lakes Basin, Bottled Water Markets and External Trade*. A report to the International Joint Commission, November 30, 1999 (unpublished).

20 Hidell-Eyster International, Hingham, Mass. *A Perspective on Water: Bottled Water Markets, and Bottled and Bulk Water Trade between the United States and Canada*. A report to the International Joint Commission, July 12, 1999 (unpublished).

that it has issued to bottling companies. It appears that most of this water remains within the Great Lakes Basin. While the Commission is sensitive to the potential importance of this matter to local groundwater regimes, at this time the Commission believes that this is not a significant issue with respect to the level of Great Lakes waters and that local effects can be managed best at the local level.

Ballast water, which is used to stabilize vessels, has always been considered a noncommercial item. No evidence has been found to suggest that any ballast water taken from the Great Lakes Basin is sold abroad. It should be noted that water quality is not an issue for the purpose of establishing ballast, but discharging ballast water can lead to the introduction of alien invasive species. A number of these species are now prevalent throughout the Great Lakes Basin. Over a recent nine-year period, the net loss of water from the Great Lakes Basin as a result of ships taking on ballast water in the lakes was equivalent to an average annual flow of 0.02 cms (0.7 cfs)[21].

Potential for Future Diversions and Removals. Many speakers at the public hearings on the Interim Report said the Commission too readily dismissed the threat of major diversions from the Great Lakes to other regions, especially the Southwestern states. They indicated that while an analysis of past proposals for mega-diversions indicates that they may not have been feasible, at least from an economic standpoint, this does not mean that proposals of this kind could never be pursued for economic or other reasons. While the Commission acknowledges the anxiety expressed by some at the hearings, the Commission continues to believe that the era of major diversions and water transfers in the United States and Canada has ended Barring significant climate change, an overcoming of engineering problems and of numerous economic and social issues, and an abandonment of national environmental ethics, the call for such diversions and transfers will not return. At present, there do not appear to be any active proposals for major diversion projects either into or out of the Basin. There is little reason to believe that such projects will become economically, environmentally, and socially feasible in the foreseeable future.

In the United States, the era of major diversions and water transfers was linked to the transcontinental movement of population and industry, which fostered a dynamic of resource exploitation to support new settlements and new economic activity. In the western United States, engineers created, at tremendous cost, networks of dams, reservoirs, and canals to harvest water sources to support power generation, irrigation, human consumption, and sanitation. As the west moves into the 21st century, concerns are turning to ecosystem restoration and environmental remediation, and sustainable management has begun to guide regional planning principles.

The mega-projects that have already been completed targeted the most easily accessible areas. Future mega-diversions would present many additional engineering challenges. Although most of these challenges could be overcome, the costs of such projects, whether by pipeline or channel, remain enormous. Not only must capital be invested in the construction of the project, but also operating and maintenance funds must be found to support the effort. Every study of such projects has highlighted the high energy costs associated with the pumping of water over topographic barriers. Mega-diversions also require rights-of-way for their passage and security for the products being transported, which would be difficult to obtain. The environmental costs of such projects in terms of disruption of habitat and species movement are enormous. A project similar to the current California Aqueduct would represent 75 percent of the current consumptive use in the Great Lakes Basin and would, prima facie, have a major environmental impact on aquatic and terrestrial resources. Increasingly, water managers recognize the validity of pricing water at its true value, making it far more cost effective to increase the available supply of water by using existing supplies more efficiently as they are allocated among basin interests.

The 1998 Report of the Western Water Policy Review Advisory Commission[22] confirmed earlier expert analysis that Western states have options for water that are less expensive and less open to legal challenge than long-distance import of water from the Columbia, Missouri-Mississippi, or Great Lakes basins. The popula-

[21] Annual data, 1991-99, on ships carrying ballast, provided by P. Vincelli, St. Lawrence Seaway Management Corporation, Cornwall, Ontario, March 1, 1999.

[22] U.S. Western Water Policy Review Advisory Commission. *Water in the West: Challenge for the Next Century.* Report of the Commission, June 1998. NTIS, Springfield, Virginia.

tion of the Western states is continuing to grow faster than the national average. It is an urban population and may be able to afford to buy and lease existing water rights from the less-productive agricultural sector. Water savings are already being realized by some cities in the Southwest as a result of conservation measures and improved irrigation practices. The fact that agriculture still accounts for almost 80 percent of water withdrawals in Western states, most of it for low-value crops like alfalfa and corn, indicates that there will continue to be significant opportunities for reallocation of existing supplies for the foreseeable future.

Even if mega-diversions were technically and economically feasible, current water management thinking recognizes that the political difficulties of managing water effectively increase as one moves beyond a single basin. Although it can be very difficult to do so effectively, those who share a basin generally recognize the importance of working together to manage both excess and shortfall, as well as water quality. Agreeing to cooperate across both political boundaries and basin divides is even more difficult, and it would be impossible for Great Lakes jurisdictions to guarantee an uninterruptible supply to a non-Basin consumer of water Some interests in the Great Lakes Basin, such as riparian homeowners, might welcome a means of removing water from the Basin during periods of extremely high levels. Most interests, including in-stream interests, commercial navigation, and recreational boating, would be adamantly opposed to such removals in periods of low levels. Diversions during droughts would, however, be difficult to interrupt because of the dependency that diversions create among recipients. The Commission recognizes that once a diversion to a water-poor area is permitted, it would be very difficult to shut it off at some time in the future.

The Chicago Diversion, where infrastructure already exists, is a possible exception to the technical and economic impediments to additional major diversions. There were expressions of anxiety in public hearings about this possibility, which would, of course, lower Lakes Michigan–Huron and the downstream system, impair navigation, and reduce hydroelectric power generation in the Niagara and St. Lawrence Rivers. In fact, during a period of high water in the Great Lakes in the mid-1980s, a Commission study team evaluated the possibility of increasing the Chicago Diversion to reduce water levels. Shortly thereafter, there were calls, during a period of low water in the Mississippi River Basin, to increase the diversion for a limited period to ease navigation difficulties on the Mississippi River. In the 1980s, further diversions from the Great Lakes were reviewed, including the possibility of increasing the Chicago Diversion to replace water diverted from the Arkansas River Basin to help replenish the Ogallala aquifer[23]. In all cases, it was determined that such diversions would either not achieve the intended objectives or were too expensive to be practical. Any effort to increase the diversion in periods of either high or low water would have to overcome potential opposition from some downstream Mississippi Basin states and from Canada, the reluctance of any Great Lakes states to allow any increase in the diversion lest it become permanent, and the need for U.S. Supreme Court approval.

The Chicago Diversion was designed for a flow of 10,000 cfs (283 cms). When the Boundary Waters Treaty was signed in 1909, the U.S. government had already limited the Chicago Diversion to 4,167 cfs (118 cms)[24]. Subsequent urban development limits the diversion to 8,700 cfs (246 cms); flows above this level will damage property along the diversion.

In the short run, pressures for small removals via diversion or pipeline are most likely to come from growing communities in the United States just outside the Great Lakes Basin divide where there are shortages of water and available water is of poor quality. The cost of building the structures needed to support such diversions would be relatively small by comparison to the cost of building structures to move water vast distances. Population distribution[25] suggests that several communities that straddle or are near the Great Lakes Basin divide, particularly communities in Ohio, Indiana, and Wisconsin, may look to the Great Lakes for a secure source of municipal and industrial water supplies in the future. Such diversions would require the approval of the Great Lakes governors under the Water Resources Development Act of 1986 (WRDA), and they would fall

23 B. G. DeCooke, J. W. Buckley, and S. J. Wright (1984). "Great Lakes Diversions, Preliminary Assessment of Economic Impacts." *Canadian Water Resources Journal* 9(1):1–15.

24 1899 permit from the U.S. Secretary of the Army (Rivers and Harbors Act of 1899) 266 US AT431.

25 Government of Canada and U.S. Environmental Protection Agency. *The Great Lakes: An Environmental and Resource Book*. Third Edition, 1995.

within the provisions of the Great Lakes Charter. The only diversions approved in the United States under WRDA procedures to date have resulted in no net loss of water to the Great Lakes Basin. In Ontario, because of geography, there are currently no such pressures along the border of the Basin to draw on Great Lakes water, nor are there likely to be any in the future.

At a lesser level, water may be transferred in bulk by trucks or marine tankers. Because water is heavy, it is expensive to move. The geography of the region and the inability of the St. Lawrence Seaway to handle large tankers are such that the commercial viability of long-distance trade in bulk water from the Great Lakes appears uneconomical. Moreover, other countries with abundant water supplies are located much closer to prospective foreign markets than are the Great Lakes. Even the California–Mexico border region could be served more effectively from the Pacific Northwest, Alaska, and Panama than from diversions or ocean tankers drawing water from the Great Lakes, and there are more readily accessible sources of water on the East Coast of North America.

Towing large fabric bags filled with water is a variation on freshwater export by ocean tanker. This technique has been used since late 1997 to provide water from the mainland to some of the Greek islands and to the Turkish part of Cyprus[26]. Apparently, these short-haul arrangements in the Mediterranean have reduced the cost of delivery to under $1 U.S. per cubic meter, but the limited capacity of the Great Lakes–St. Lawrence system and longer ocean distances may rule out the use of this technology in the Great Lakes Basin.

The difficulty and the expense of moving water in bulk are forcing water managers around the world to place greater emphasis on the efficient use of existing local sources Treated domestic and industrial wastewaters are being used for many purposes, including lawn watering and agricultural irrigation. As demand for urban water supplies increases, communities are seeking to manage their demands rather than increase their supplies. In some areas, implementation of conservation techniques has reduced demand by as much as 50 percent. In other areas, water rights markets have shifted available water from agricultural to urban uses.

Desalination is another promising alternative to long-distance diversion (or shipment) of water. Santa Barbara chose during the California drought a decade ago to build a desalination plant in order to guarantee a reliable supply of water in preference to importing water by tanker and/or reducing system-wide use. More recently, Quebec has concluded that in most instances, the cost of desalination would be about half that of transporting freshwater long distances by ship. By late 2002, Tampa, Florida, will begin blending desalinated water with freshwater at costs that are competitive with the costs of developing new freshwater sources. Desalination technology is improving rapidly. Hybrid desalination systems, which combine thermal and membrane filtration, are lowering costs significantly, and throughout the world, new desalination projects worth billions of dollars are scheduled to come on-line over the next two decades[27].

Privatization. It is evident from the Commission's public hearings that many people are concerned about the growing trend toward private sector involvement in water utilities worldwide. Privatization incorporates a spectrum of private–public relationships such as entirely private, private with public oversight, and private management contracts. Governments are divesting themselves of their investments and services in order to promote capital inflow, efficiency, and solvency[28]. For example, Milwaukee, Toronto, Hamilton–Wentworth, and other cities in the Great Lakes Basin are involving the private sector in water or wastewater systems. Private sector involvement may lead to efficiencies, improved technology, improved customer service, and reduced cost[29]. In addition, other benefits include conservation, improved adherence to local and federal regulations, and increased spending on research and development.

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26 Peter H. Gleick (1998). *The World's Water, 1998–1999: The Biennial Report on Freshwater Resources.* Island Press, Covelo, California. (See pp. 200–205, water bag technology.)

27 www.wateronline.com/read/n119990830/9125. See also the report on a conference: International Water Resources Association (1999). "The Role of Desalination in Averting a Global Water Crisis." *Water International* 24(4):395–400

28 According to a recent study conducted by the U.S. Conference of Mayors, 4 of every 10 cities are considering some form of privatization in hopes of reducing costs and encouraging private capital investment.

29 La Compagnie Suez Lyonnaise des Eaux, a private French company, manages and operates, in varying degrees, water utilities through

However, public divestiture of utilities may have its disadvantages. The public raised concerns that profit-oriented private firms may act at the expense of the public since profits are directly related to high rates of consumption, lower expenditures, and/or higher rates in the water services industry. Also, there is some evidence that companies may be more lax on public and environmental safety standards to increase profits because there is little regulation and public accountability[30].

An increasing amount of privatization will require that attention be paid to government regulations and their enforcement to ensure that public goals with respect to such matters as high water quality, other aspects of environmental quality, conservation, equity, and efficiency are fully satisfied. This includes ensuring that public and private sector water managers are held accountable for the achievement of these public goals and for protection of public health.

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contractual arrangements made with municipalities, cities, and communities all over the world. They pride themselves on improved technology, improved water quality, and improved customer service while making profits. For example, one year after Lyonnaise signed the contract in Casablanca, satisfied customer approval rating increased to 80 percent, and 1,000 km of wastewater mains were scoured. Also, in the United Kingdom, Thames Water International has invested more than $1.6 billion U.S. on infrastructure. Among the improvements was the installation of new technology that detects leaks. The water that the company loses to leakage each year has declined by 31 percent since 1996.

30 British water utilities were entirely privatized in 1989. Since then, some private firms in control of water utilities in England and Wales have been convicted of pollution violations. Regulation in the water services industry is extremely inefficient, in part because the Natural Rivers Authority has to work through numerous agencies. (Some publicly owned and operated utilities in North America have also been convicted of pollution violations).

Section 4

Cumulative Effects

Human intervention has affected the Great Lakes ecosystem at the local level as well as at the system-wide level, and the effects (impacts) are both short-term and long-term. The Commission has identified the basic physical (abiotic or nonliving) impacts of human use and activity on the current water levels in the Basin and has worked to identify the ensuing impacts of these and possible future changes on the living components of the ecosystem. Human interventions (withdrawals, consumptive uses, regulation, dredging, land use, etc.) are inherently cumulative. The impact of localized, small-scale activities may be difficult to quantify on an individual basis but, collectively, they can significantly alter the level and flow regime and associated ecological conditions.

Existing consumptive uses have lowered the levels of the Great Lakes from less than 1 cm (0.4 in.) to 6 cm (2.4 in.) (Table 3). This impact has been far exceeded by other anthropogenic activities. The inflows from the Long Lac and Ogoki Diversions have raised lake levels, and the outflows from inter- and intrabasin diversions have lowered lake levels. The largest human-induced impact on lake levels has come from the channel work on the St. Clair and Detroit Rivers; this dredging and mining for gravel has lowered the levels of Lakes Michigan and Huron by 40 cm (15.8 in.). The Commission's orders of approval governing the operations of the structures on the St. Marys and St. Lawrence Rivers have established desirable ranges for levels in Lakes Superior and Ontario to avoid very low or very high levels and the consequent impacts that very low and very high levels have on Great Lakes interests.

There is interaction among these changes, bringing about cumulative impacts. Cumulative impacts in ecosystems involve past, present, and reasonably foreseeable effects that are seldom simply the sum of the changes. Even modest changes induced by individual, discrete actions have incremental and other cumulative impacts on both a localized and system-wide basis. These implications become more pronounced as one proceeds downstream through the Great Lakes–St. Lawrence system.

Although changes to lake levels and outflows are relatively easy to determine, the impact of these changes is subject to interpretation. The impacts of the changes in levels on the ecosystem as a whole, and especially on its lake and river subsystems, are not well understood. For example, construction of the power and navigation projects on the St. Lawrence River in the late 1950s forever changed the character of the river. Some argue that the environmental changes brought about by the project have done incalculable harm. Others have built their lives on the basis of the new river–lake system and would be devastated by a return to pre-project conditions. In fact, the overall effects of the changed regime have not been fully assessed.

The Commission is aware of only one assessment of the overall effects of water diversions. In 1979 the U.S. Army Corps of Engineers conducted an assessment of a major increase in the Chicago Diversion on the Great Lakes[31].

[31] *Environment Assessment: Proposed Increased Lake Michigan Diversion at Chicago, Illinois, Demonstration Program.* U.S. Army Engineer District, Detroit. Contract No. DACW35-79-C-0036, November 1979.

Table 3: Impacts of diversions, consumptive use, and outlet channel modifications on water levels in the Great Lakes.

On Lake Levels in Centimeters

	Superior	Michigan-Huron	St. Clair	Erie	Ontario
Recorded Levels 1918-1997 (meters)	183.43	176.49	175.02	174.15	74.75
Long Lac-Ogoki (160 cms) (inflows)	6	11	N/A	8	7
Chicago (90 cms) (outflows)	-2	-6	N/A	-4	-3
Welland Canal (260 cms)	-2	-6	N/A	-13	0
Detroit / St.-Clair modifications	0	-40	N/A	0	0
Niagara River outlet	0	3	N/A	12	
Existing consumptive uses (1993)	-1	-5	-5	-4	-6
Impacts (cm):	1	-43	N/A	-1	-2

On Flows in Connecting Channels (in cubic meters per second)

	St. Mary's R.	St. Clair R.	Detroit R.	Niagara R.	St. Lawrence R.
Recorded flows 1918-1997 (cms)	2150	5200	5350	5940	6980
Long Lac-Ogoki (160 cms) (inflows)	160	160	160	160	160
Chicago (90 cms) (outflows)	0	-90	-90	-90	-90
Welland Canal (260 cms)	0	0	0	-260	0
Existing Consumptive Uses (1993)	-10	-50	-50	-90	-110
Total Impacts (cms):	150	20	20	-280	-40

Notes: N/A is Not Available
St. Lawrence River flows measured at Cornwall

Experts participating in a Commission workshop on cumulative impacts concluded that it is difficult to quantify with any degree of precision the ecological impacts of most water withdrawals, consumptive uses, and removals[32]. In particular, impact assessment data and information are lacking with respect to fisheries productivity and composition, the extent and range of coastal wetlands, near-shore water quality, habitat and the degree of slope lakeward of the habitat, and biodiversity.

The dynamic nature of the Great Lakes-St. Lawrence system and the multiplicity of physical, chemical, and biological processes affecting ecosystem status challenge science's ability to establish and characterize causal relationships between a given water use and its impact on levels, flows, and fluctuations, on any observed changes in the ecosystem, and on economic uses of the system. These challenges will always be difficult to deal with, and additional research clearly is warranted in several areas[33].

It is unlikely that cumulative assessment tools will ever be able to deal comprehensively with all the uncontrollable and unknown factors and all the uncertainties, surprises, and complex, nonlinear interrelationships that are inherent in a vast ecosystem. Nevertheless, efforts to conduct such assessments must continue.

Given the uncertainties associated with future climate change, consumptive use, and possible pressures for removals, and given the additional uncertainties associated with impact assessment methodologies, a precautionary approach is appropriate. Toward this end, consideration should be given to policies that are well advised from an ecological and economic standpoint irrespective of climate change or unforeseen demands.

32 International Joint Commission, U.S. and Canada, November 1999. *Cumulative Impacts in the Great Lakes-St. Lawrence River Ecosystem.* Summary paper of a workshop held September 29-30, 1999, Windsor, Ontario, in support of the International Joint Commission's Water Uses Reference.

33 N. LeRoy Poff, J. David Allan, Mark B. Bain, James R. Karr, Karen L. Prestegaard, Brian D. Richter, Richard E. Sparks, and Julie C. Stromberg (1997). "The Natural Flow Regime." *BioScience* 47(11):769-784.

A literature review conducted in conjunction with the experts workshop provided key findings from studies related to assessment of impacts of changes in water levels and a listing of methodologies that could be useful in assessing impacts of changes in water levels. Through the literature review, it became evident that meaningful assessments have been limited by unavailability of information and by a lack of science to support analysis. Meaningful assessments are also limited by an inability to go beyond assessment of individual impacts. The literature review pointed out the uncertainties associated with conducting assessments and the variety of challenges faced in determining the appropriate methodology to be used.

For the 21st century, there is a great deal of uncertainty regarding factors such as future consumptive use, small-scale removals of water, and climate change. Despite this uncertainty, present indications are that all three factors are likely to place downward pressures on water levels, with reinforcing impacts. Although there are insufficient data and inadequate scientific understanding to place precise estimates on the magnitude and timing of such impacts, the impacts could be significant. This—and the prospect of adverse cumulative impact of new human interventions—suggests a need for great caution in dealing with those water use factors that are within the control of Basin managers.

Climate Change

Two decades after the 1979 World Climate Conference, there is still considerable debate over how fast human-induced climate change will take place, how extreme it will be, how dangerous such changes will be for ecosystems, including socioeconomic systems, and just how aggressively the global community should seek to mitigate the issue. There are, however, some points of consensus. The rate of increase in concentrations of greenhouse gases in the atmosphere is related to human activity, and, at a minimum, a doubling of carbon dioxide concentrations in the atmosphere will occur in the 21st century, with a corresponding increase in the average global temperature of 1-4 degrees C. There is also a reasonably strong consensus that the science is sound and that "the balance of evidence suggests there is discernible human influence on the climate system."[34]

In recent decades, scientists have become increasingly concerned about changes taking place in the atmosphere, particularly the increasing concentrations of greenhouse gases. There is growing evidence that the changing composition of the atmosphere is beginning to influence specific components of the hydrologic cycle, even though it is not yet possible to differentiate such effects from the natural variability of Great Lakes levels. Over the past several decades, trends in hydrologic variables in the Basin and in the vicinity of the Basin have generally been consistent with changes projected by and inferred from climate models, in terms of increases in temperature, precipitation, and evaporation. Although it is not yet possible to differentiate such effects from the natural variability of climate, these research results are generally what would be expected with "enhanced greenhouse effect" warming.

Results from computer climate models have been used to explore impacts on various water-related interests, assuming likely scenarios of future atmospheric greenhouse gas concentrations and, in some cases, sulfate aerosol concentrations. The information from these models has been used to develop climate scenarios that have been input to hydrologic models. Early impact assessments, based on equilibrium 2 x CO_2 scenarios, suggest global warming will result in a lowering of water supplies and lake levels and in a reduction of outflows from the Basin. Based on projections using several state-of-the-art models[35], experts from the U.S. National Oceanic and Atmospheric Administration (NOAA) and Environment Canada believe that global warming could result in a lowering of lake level regimes by up to a meter or more by the middle of the 21st century, a development that would cause severe economic, environmental, and social impacts throughout the Great Lakes region.

Experts associated with the U.S. National Assessment on the Potential Consequences of Climate Variability and Change indicate the possibility of both slightly increased and decreased lake levels as a result of their analysis of climate models. The National Assessment is focusing on two tran-

34 Intergovernmental Panel on Climate Change (IPCC) (1996). *IPCC Second Assessment Synthesis of Scientific-Technical Information Relevant to Interpreting Article 2 of the UN Framework Convention on Climate Change.* Cambridge University Press, New York.

35 L. Mortsch and F.H. Quinn (1996). "Climate Change Scenarios for Great Lakes Basin Ecosystem Studies." *Limnology and Oceanography* 41(5), 903-911. Also, T. E. Croley II (1992). CCC GCM 2xCO2 hydrological impacts on the Great Lakes. *Climate, Climate Change, Water Level Forecasting and Frequency Analysis: Supporting Documents Vol. 1, Water Supply Scenarios,* Task 2, Working Committee 3, IJC Levels Reference Study, Phase II.

sient, coupled atmosphere- ocean general circulation models[36] (GCMs) that generally result in increased precipitation and temperature in North America as a whole, although one more dramatically than the other, in the long run (2090)[37]. Of particular note, these two models reach different projected outcomes in 2030 and 2090 for net supplies and water levels in the Great Lakes Basin[38]. Given the large discrepancies in some results of the models, there continues to be a high degree of uncertainty associated with the magnitude of potential changes.

Many analysts recognize that results from the analysis of general circulation models indicate that global warming will change global precipitation patterns, with different amounts of rainfall over the course of the year. Warmer conditions may also lead to more precipitation falling as rain rather than as snow; less snow cover and shorter duration of both snow and ice cover; earlier snow melt; more runoff in winter; and a greater likelihood of less runoff in summer because of higher evaporation and the earlier onset of spring melt, with less runoff because of less snow pack. Many analysts believe that there will be increased frequency of heavy, short-duration rains in some regions interspersed with dry spells, and more pronounced droughts. All these factors indicate a shift in the peak volume and timing of rainfall and runoff, which may change the timing of increases and decreases of lake water levels. Thus, areas that receive roughly the same amount of total annual precipitation could be forced to alter water management practice significantly to take into account large changes in seasonal patterns of precipitation.

The question with respect to average Great Lakes levels is whether, in the long term, increases in evaporation due to global warming will significantly offset increases in precipitation, thereby reducing net water supplies. It is impossible at this time to conclusively differentiate shorter-term natural variability from any longer-term trend in the historical record. Great Lakes levels and lake level interests are highly sensitive to climatic variability, as illustrated by the impact of high water levels in the early 1950s and the mid-1980s and of low water levels in the 1930s and the mid-1960s. Significant variability will continue whether or not human-induced climatic change is superimposed on these natural fluctuations. From a policy perspective, this uncertainty does not alter the risk posed by climate change.

Climate change suggests that some lowering of water levels is likely to occur. The Commission's study team examined the subject of changing water levels and found that the effects of high water levels have been dealt with in the recent past[39]. However, should lower water levels occur, the factors noted below may be indicative of some of the impacts that could be significant for the economy, the social fabric, and the natural environment of the Great Lakes ecosystem[40]. It should be noted that adaptation measures would moderate some of these impacts.

- There would be losses in hydroelectric power generation. Even though they would not be nearly as severe as those projected in climate change scenarios, record low levels and flows in the 1960s caused hydropower losses of between 19 percent and 26 percent on the Niagara and St. Lawrence Rivers[41]. A small proportion of these losses would be offset by lower heating costs, but this in turn would be offset by increases in air conditioning costs.
- Great Lakes shipping costs could increase significantly because of reduced drafts in shipping channels and increased dredging costs. At least some of these costs might be offset by a longer shipping season.
- Flood damage in shoreline areas would decrease as long as new development was not permitted to encroach on the newly exposed land.

36 The report for the U.S. National Assessment is expected to be issued in April 2000.

37 U.S. National Assessment. "Model Intercomparisons." http://www.cgd.ucar.edu/naco/gcm/tmppt.html. (16 Feb 2000). Also, see B. Felzer and P. Heard (1999). "Precipitation differences amongst GCMs used for the US National Assessment." *Journal of the American Water Resources Association* 35(6):1327-1338.

38 F. H. Quinn and B. M. Lofgren (2000). "The influence of potential greenhouse warming on Great Lakes hydrology, water levels, and water management." *Preprints 15th Conference on Hydrology*, Jan 9-14, 2000, pp. 271-274.

39 *Methods of Alleviating the Adverse Consequences of Fluctuating Water Levels in the Great Lakes-St. Lawrence River Basin.* International Joint Commission report to the governments of the United States and Canada, December 1993.

40 Water Use Reference Study Team Final Working Paper to the Commission on Cumulative Impacts/Risk Assessment, July 1999.

41 H. Hartmann (1990). "Climate Change Impacts on Great Lakes Levels and Flows: Energy and Transportation Implications." in G. Wall and M. Sanderson (eds.) *Climate Change: Implications for Water and Ecological Resources.* Occ. Paper no. 11. University of Waterloo, Department of Geography Publ. Series, Waterloo, Ontario, 239-246.

- There would be significant detrimental effects on recreational boating and sport fishing[42].

- Shoreline-based infrastructure would experience problems similar to those experienced in the 1960s, including less attractive scenic views, inaccessible docking facilities, and the need to modify water intakes and waste disposal outlets. Some shoreline properties may become attractive to people looking for vacation homes near lakes because of low water levels.

- A reduction in the water levels of Montreal Harbour would have a major effect on all deep-draft commercial navigation. The adaptation measures could include significant channel dredging and the associated issue of where to put the dredge spoils.

- Finally, there could be reductions in freshwater discharges into the St. Lawrence estuary, gulf, and beyond, affecting fish populations and other components of the St. Lawrence and Atlantic ecosystems.

The analysis of the general circulation models suggests that a notable difference between the results discussed above and previous climate change studies is the timing of the change in lake levels and connecting channel flows. There is a need for further research to help predict future weather and climate with more certainty and for impact assessments that define the vulnerability. The continually developing research would provide water managers with information so they may address coping mechanisms—such as developing water management plans to handle extremes—that alleviate the possible wide range of climate change effects. At a minimum, cost-effective measures should be taken that would modify those human activities that contribute to changes in climate and other unsustainable environmental impacts on resources.

Although uncertainty is inherent in climate models, it should not be assumed that climate change impacts on the Great Lakes Basin ecosystem would take place gradually over the next several decades. Human-induced climate change will be superimposed on normal climate variability and natural events like El Niño/La Niña. The timing and regional patterns of precipitation and runoff could change and have a dramatic effect on water levels and outflows. In summary, the Commission believes that considerable caution should be exercised with respect to any factors potentially reducing water levels and outflows.

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42 Even if water levels do not change significantly, a warming of the Lakes could significantly change the structure of the fish population, with the number of cool- and warm-water fish gradually rising and the number of cold-water fish declining. In addition, warmer climate could reduce the frequency of water-column turnovers, a development that would adversely impact fish species and their habitats by altering nutrient and dissolved oxygen distributions.

Section 6

Groundwater

Groundwater is an important source of water for many segments of the Great Lakes community. Humans use groundwater primarily for public supply and for irrigation, industrial, commercial, and domestic purposes. Some members of the biotic community–for example, cave-dwelling fish, cave-dwelling crayfish, cave-dwelling insects, some kinds of funguses, and some microorganisms–spend all their lives underground and are completely dependent upon groundwater. Additionally, the vadose zone (the occasionally saturated permeable substrate) is home to a number of organisms–many of them microorganisms–that emerge from dormancy during periods of water saturation and return to dormancy during periods of dessication.

Recent U.S. studies have estimated that groundwater makes a significant contribution to the overall water supply in the Great Lakes Basin[43]. Indirect groundwater discharge accounts for approximately 22 percent of the U.S. supply to Lake Erie, 33 percent of the supply to Lake Superior, 35 percent of the supply to Lake Michigan, and 42 percent of the supply to Lakes Huron and Ontario (Figure 5). Over most of Ontario, the contribution of groundwater to stream flow is less than 20 percent; this is because of the predominance of silt and clay or poorly fractured bedrock at the surface. However, in some portions of the Lake Erie and Lake Ontario basins, where sand and gravel are found at the surface, the contribution of groundwater to local streams can be as high as 60 percent or more.

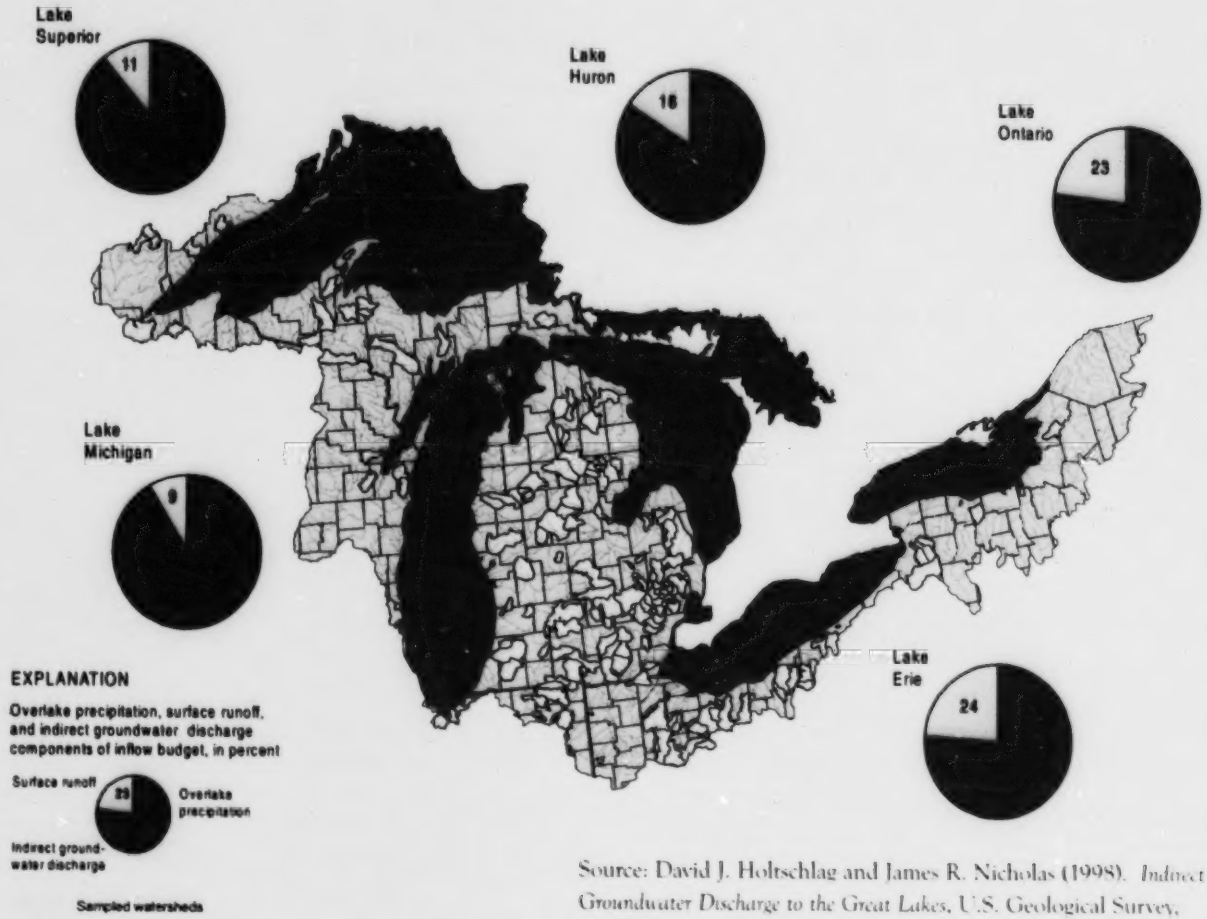
Groundwater's contribution to stream flow is significant as, among other things, it ultimately affects lake levels. Groundwater discharge is also a significant determinant of the biological viability of tributary streams. In undisturbed areas, groundwater discharge throughout the year provides a stable inflow of water with generally consistent dissolved oxygen concentration, temperature, and water chemistry. In disturbed areas where, for example, land uses have significantly reduced groundwater flow to a stream, stream reaches may experience diminished biological viability. Where land uses add contaminants, streams may also lose viability.

In the Great Lakes Basin, the groundwater system is recharged mainly by infiltration and percolation of precipitation. Withdrawal of groundwater at rates greater than the recharge rate causes water levels in aquifers to decline. If the amount of decline is sufficient, water may be drawn from streams or lakes into the groundwater system, thus reducing the amount of water discharging to the Great Lakes. This is indicative of the inextricable link between ground and surface waters.

Groundwater withdrawals at rates high enough to warrant concern have been and are taking place at a number of locations. Among the best known of these are high-volume withdrawals in the Chicago–Milwaukee metropolitan region. There, in 1979, in the eight-county northeastern Illinois area, deep-aquifer withdrawals from the Cambrian–Ordovician aquifer system peaked at 693 million liters per day (mld) (183 mgd) . During this same period, maximum pumpage (withdrawals) for Milwaukee from the Cambrian–Ordovician aquifer system reached 212 mld (56 mgd). This large-scale pumping produced cones of depression in aquifers under Milwaukee and Chicago, with

[43] D. J. Holtschag and J. R. Nicholas (1998). *Indirect Groundwater Discharge to the Great Lakes.* U.S. Geological Survey Open-File Report 98-579. Also see S.N. Singer, C.K. Cheng, and M.G. Scafe (1998). *The Hydrogeology of Southern Ontario.* Ontario Ministry of the Environment and Energy, Environmental Monitoring and Reporting Branch, Toronto.

Table 5: Basin Water Supply for the U.S. portion of the Great Lakes.



Source: David J. Holtschlag and James R. Nicholas (1998). *Indirect Groundwater Discharge to the Great Lakes*, U.S. Geological Survey, Open-File Report 98-579.

declines in the levels of groundwater as great as 114 and 274 m, respectively (375 and 900 ft., respectively). As a result of lower pumping rates since 1980, groundwater levels in the Chicago area have recovered as much as 76 m (250 ft.) in some localities, but groundwater levels are continuing to decline in the southwestern part of the Chicago metropolitan area[44].

Groundwater consumption and groundwater recharge in the Great Lakes Basin are not well understood. Reasons for this include the following:

- There is no unified, consistent mapping of boundary and transboundary hydrogeological units.
- There is no comprehensive description of the role of groundwater in supporting ecological systems.
- Although some quantitative information is available on consumptive use, in many cases the figures are based on broad estimates and do not reliably reflect the true level and extent of consumptive use.
- There are no simplified methods for identifying large groundwater withdrawals near boundaries of hydrologic basins.
- Estimates are needed of the effects of land-use changes and population growth on groundwater availability and quality.

44 A. P. Visocky (1997). *Water-Level Trends and Pumpage in the Deep Bedrock Aquifers in the Chicago Region, 1991–1995*. Illinois State Water Survey Circular 182.

- There is inadequate information on groundwater discharge to surface water streams and inadequate information on direct discharge to the Great Lakes.

- There is no systematic estimation of natural recharge areas.

In the strictest sense, a groundwater basin may be defined as a hydrogeologic unit containing one large aquifer or several connected and interrelated aquifers. In practice, the term "groundwater basin" is loosely defined and implies an area containing a groundwater flow system capable of storing or furnishing a substantial water supply. The groundwater basin includes both the surface area and the permeable materials beneath it.

The concept of a groundwater basin becomes important because of the hydraulic continuity that exists for the contained groundwater resource. A groundwater basin may or may not coincide with a surface physiographic feature—that is, water in an aquifer under a lake or river may actually flow away from the lake or river and be deposited in a different surface-water basin. In a valley between mountain ranges, the groundwater basin may occupy only the central portion of the stream drainage basin. In limestone and sandhill areas, drainage and groundwater basins may have entirely different configurations. The physical boundaries of the groundwater basin are formed, in some instances, by the physical presence of an impermeable body of rock or a large body of surface water.

Other boundaries form as a result of hydrologic conditions. These boundaries are hydraulic boundaries that include groundwater divides. A groundwater divide can be visualized as a ridge in the water table from which groundwater moves away in both directions at right angles to the ridge line. Groundwater divides form hydraulic boundaries whose locations are influenced by the presence of surficial features—for example, topographic lows that hold major rivers and topographic highs from which waters drain—and by hydraulic stresses including pumping from wells and recharge. All hydraulic boundaries, including those that coincide with physical features, are transitory in that these hydraulic boundaries may shift location or disappear altogether if hydrologic conditions change.

Groundwater basins may have boundaries that are considerably different from the boundary of the surface water basin under which the groundwaters lie. In fact, there may be several groundwater basins layered at different depths, and each of these groundwater basins may have a boundary that does not coincide with the boundary of the surface water basin under which it is found. Accurate mapping of groundwater basins has the potential to bring about changes in how we manage the withdrawal of groundwater as well as in how we manage the interlinked surface waters. In any case, owing to the interconnection of surface water and groundwater, whether water consumption is from the lakes, the tributaries, or groundwater sources, the eventual physical impact on average lake levels is virtually identical.

Section 7

Conservation

The first step in sound management of resources and the exercise of the precautionary principle is conservation. Some consumption, of course, is essential to the functioning of the human element of ecosystems. Currently, consumptive use in the Great Lakes Basin is relatively small and is likely to experience only modest increases into the foreseeable future. However, the cumulative impact of past activity and the likelihood of future change will further stress the integrity of the Great Lakes ecosystem and its ability to respond to change. Global warming will likely increase and will likely change patterns of consumptive use; in particular, higher average temperatures in the Basin could result in increased agricultural activity and water consumption in the longer term. Because of a possible downward trend in net Basin supply in the 21st century, water-conservation and demand-management practices should become increasingly important components of any overall sustainable use strategy. Governments and citizens alike can best prepare for future uncertainty and protect the health of the Great Lakes ecosystem by imbedding a robust ethic of conservation into education and into every level of planning and execution.

Experience has shown that conserving water by using it more efficiently makes sound economic and environmental sense in that infrastructure costs for water supply and wastewater treatment are reduced, energy use is reduced, cost efficiencies are increased by reducing the volumes of water and waste to be treated, resiliency of the ecosystem is improved by reducing withdrawals, and exemplary behavior is demonstrated to others.

On a basin-wide scale, implementation of the Basin Water Resources Management Program—to which the states and provinces are committed under the Great Lakes Charter—could provide the opportunity to launch a water-conservation initiative. Sharing of conservation experiences among Basin jurisdictions should be an integral part of the overall approach to cooperative programs and practices. Cooperating jurisdictions may wish to adopt some common approaches, as appropriate, in their water-conservation plans, including incentives to encourage water demand-management initiatives and the installation of best practicable water-saving technology.

A 1999 report by the Organization for Economic Cooperation and Development (OECD)[45] compares water use in the European Union with water use in the United States and Canada and indicates that there are opportunities to reduce waste and inefficient uses and to achieve energy and infrastructure cost savings. The report notes that the United States and Canada use (withdraw) nearly twice as much water per capita as the OECD average. Even taking into account differences in economic structure and lifestyle between the United States and Canada and other OECD countries, it would appear that improvements in water use could be made by using appropriate, existing water-conservation and demand-management techniques.

Demand management shifts traditional thinking away from going after new water supplies to more efficient use of the resource. Central to the concept of demand management is the setting of prices in such a way that the amount of water used by any activity is a function of price. Much can be done in many areas of the Basin to use water more efficiently by such measures as adopting

45 OECD Report (1999). *The Price of Water: Trends in OECD Countries*. Paris.

metering of all water facilities and moving more assertively to recovering the full costs of providing water services.

During the public hearings the Commission held in September and October 1999, it was suggested that the Commission should develop measurable targets for reducing water withdrawals and consumptive losses and that it should recommend that Basin jurisdictions adopt these targets. The Commission believes, however, that decisions on conservation targets and the means for achieving them are better made at the local level, where the real problems and opportunities lie and where results are more likely to be measurable. This approach makes it possible to build on experience gained in the Basin and, at the same time, allows for measures to be tailored to unique local situations. Mechanisms for sharing conservation and demand-management experience should, in the Commission's view, be an integral part of such programs as the Basin Water Resources Management Program under the Great Lakes Charter.

Section 8

Legal and Policy Considerations

Water management in the Great Lakes Basin is governed by a network of legal regimes, including international instruments and customs, federal laws and regulations in both Canada and the United States, the laws of the eight Great Lakes states and Ontario and Quebec, and the rights of Aboriginal Peoples and Indian tribes under Canadian and U.S. laws. This section is not intended to be a full discussion of all legal issues; rather, it is intended to be an identification of aspects of the legal regime that bear most directly on the issues raised in this report.

The International Legal Context

Boundary Waters Treaty. The Boundary Waters Treaty of 1909 is the primary international legal instrument governing the use of the waters of the Great Lakes Basin. The treaty established certain basic legal principles to deal with boundary and transboundary waters and created the International Joint Commission to help implement portions of the treaty. For over 90 years, the treaty has been effective in assisting Canada and the United States to avoid and resolve disputes over freshwater.

Under the treaty, boundary waters (i.e., the waters along which the boundary passes) are treated differently from transboundary rivers or tributaries. Thus, the treaty does not deal with all waters of the Great Lakes Basin in the same way. With some exceptions, Article III provides that the use, diversion, or obstruction of boundary waters must be approved by the Commission if water levels or flows on the other side of the boundary are to be affected. With respect to tributaries of boundary waters and transboundary rivers, however, Article II states that each nation reserves "the exclusive jurisdiction and control over [their] use and diversion." The treaty does not explicitly refer to groundwater.

The treaty also provides that the governments of the United States and Canada may refer issues to the Commission to investigate and to make recommendations on, in order to help the countries resolve and avoid disputes along the border. This provision of the treaty has been used many times over the years to address water quality and water quantity issues in the Great Lakes and elsewhere.

Great Lakes Charter. The 1985 Great Lakes Charter is an arrangement among the Great Lakes states and the provinces of Ontario and Quebec. Although the Charter is not binding, it focuses the Great Lakes states and provinces on a number of resource issues and fosters cooperation among them. The Charter provides that the planning and management of the water resources of the Great Lakes Basin should be founded upon the integrity of the natural resources and ecosystem of the Great Lakes Basin. Moreover, the Charter stipulates that the water resources of the Basin should be treated as a single hydrologic system that transcends political boundaries in the Basin. New or increased major diversions and consumptive use of the water resources of the Great Lakes are said to be matters of serious concern, and the Charter states that "[it] is the intent of the signatory states and provinces that diversions of Basin water resources will not be allowed if individually or cumulatively they would have any significant adverse impacts on lake levels, in-basin uses and the Great Lakes Ecosystem."

The Charter provides that no state or province will approve or permit any major new or increased diversion or consumptive use of the water resources of the Great Lakes Basin without notifying and consulting with and seeking the consent and concurrence of all affected Great Lakes states and provinces. The trigger point for notification and for seeking the consent and concurrence of other Great Lakes states and provinces is an average use of 5 million gallons (19 million liters) per day in any 30-day period. In order to participate in this notice and consultation process, jurisdictions must be in a position to provide accurate and comparable information on water withdrawals in excess of 100,000 gallons (380,000 liters) per day in any 30-day period and must have authority to manage and regulate water withdrawals involving a total diversion or consumptive use of Great Lakes Basin water resources in excess of 2 million gallons (7.6 million liters) per day average in any 30-day period.

The Great Lakes Charter also records a commitment by the signatory states and provinces to pursue the development and maintenance of a common base of data and information regarding the use and management of Basin water resources, the establishment of systematic arrangements for the exchange of water data and information, the creation of a Water Resources Management Committee, the development of a Great Lakes Basin Water Resources Management Program, and additional coordinated research efforts to provide improved information for future water planning and management decisions. Although not fully implemented, these commitments point toward the kind of cooperation and coordination that is required in the future.

On October 15, 1999, the Great Lakes governors issued a statement renewing their commitment to the principles contained in the Great Lakes Charter and pledged to develop a new agreement, based on those principles, that would bind the states and provinces more closely to collectively planning, managing, and making decisions regarding the protection of the waters of the Great Lakes[46]. The governors also pledged to develop a new common standard, based on the protection of the integrity of the Great Lakes ecosystem, against which water projects will be reviewed.

International Trade Law. One issue raised by the governments in the Reference was whether international trade obligations might affect water management in the Basin. To address this issue, the Commission, with the assistance of the study team, reviewed the relevant World Trade Organization (WTO) agreements, including the General Agreement on Tariffs and Trade (GATT) as well as the Canada–United States Free Trade Agreement (FTA) and the Canada–United States–Mexico North American Free Trade Agreement (NAFTA), and relevant case law. The Commission and its study team also consulted experts in the field.

The Commission believes it is unlikely that water in its natural state (e.g., in a lake, river, or aquifer) is included within the scope of any of these trade agreements since it is not a product or good. This view is supported by the fact that the NAFTA parties have issued a statement to this effect. When water is "captured" and enters into commerce, it may, however, attract obligations under the GATT, the FTA, and the NAFTA.

The key GATT provision with possible significance for water exports is the prohibition of quantitative restrictions in Article XI. The GATT, however, creates a number of exceptions. Of these, the most relevant to trade in water would appear to be those related to measures "necessary to protect human, animal, or plant life or health" (the "health exception") or "relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption" (the "conservation exception"). With respect to the former, there has been some debate as to whether this provision should be read broadly, so as to in effect create an "environmental" exception to the GATT, or narrowly, so as to embrace essentially traditional concerns related to sanitary and phytosanitary measures. With respect to the latter, there may be a question as to whether water is an exhaustible natural resource, although this raises less of a problem in the case of a discrete ecosystem such as the Great Lakes Basin, where only a small part of the resource is replenished annually. Both exceptions are qualified by a requirement that they "[not] be applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade."

[46] Council of Great Lakes Governors (1999). "A Statement on Protecting the Great Lakes: Managing Diversions and Bulk Water Exports." October 15, 1999. Chicago.

Although dispute-settlement panels considering these GATT exceptions have affirmed, in principle, that trade interests may have to give way to legitimate environmental concerns, it is also true that the same panels have questioned very closely whether measures nominally taken for environmental reasons have underlying protectionist elements. Clearly, then, the achievement of a coherent and consistent approach to water conservation and management in the Great Lakes Basin—an approach clearly grounded in environmental policy—would be an important step in addressing any trade-related concerns with respect to the use of Basin waters.

The NAFTA trade obligations with respect to goods, while rooted in the GATT, appear to constrain the availability of certain GATT exceptions—including the conservation exception—in some important ways, in effect making it more difficult to "turn off the tap" once trade in water has been established. These constraints do not, however, apply to the health exception, and the NAFTA wording of that exception specifically provides that it is understood by the parties to include environmental measures. NAFTA also makes provision for certain trade obligations in environmental/conservation agreements to prevail in the event of a conflict. Finally, it should be recalled that following the signing of NAFTA, the three parties issued a joint declaration that NAFTA creates no rights to the natural water resources of any party; that unless water, in any form, has entered into commerce and has become a good or product, it is not covered by the provisions of any trade agreement, including NAFTA; and that international rights and obligations respecting water in its natural state are contained in separate treaties, such as the Boundary Waters Treaty, negotiated for that purpose.

Many people who made presentations during the Commission's hearings in September and October 1999 believed that the NAFTA and WTO agreements could prevent or at least impede the United States and Canada from prohibiting the export of Great Lakes waters and the diversion of those waters. Several noted that to date, in all the cases before the WTO involving issues of protecting environmental or natural resource interests, the WTO had ruled against those interests. Some observed that the WTO decision-making process was not transparent.

Since issuing its Interim Report, the Commission has received a letter dated November 24, 1999, from the Deputy United States Trade Representative concerning the implications of international trade agreements for the protection of the waters of the Great Lakes Basin. A copy of this letter is attached (Appendix 8). The Commission has also received a document entitled Bulk Water Removal and International Trade Considerations from the Canadian Department of Foreign Affairs and International Trade (Appendix 9). These submissions generally are consistent with the Commission's views regarding the effect of international trade law on the ability of the two countries to protect the water resources of the Great Lakes Basin.

The Commission also received legal opinions from several experts. The following points synthesize the thrust of these opinions received and are intended to take into account the uncertainties and the caution expressed with respect to international trade law. They are similar to the views expressed by the Canadian and U.S. governments.

- The provisions of NAFTA and the WTO agreements do not prevent Canada and the United States from taking measures to protect their water resources and preserve the integrity of the Great Lakes Basin ecosystem where there is no discrimination by decision-makers against individuals from other countries in the application of those measures.

- NAFTA and the WTO agreements do not constrain or affect the sovereign right of a government to decide whether or not it will allow natural resources within its jurisdiction to be exploited and, if a natural resource is allowed to be exploited, the pace and manner of such exploitation.

- Moreover, even if there were sales or diversions of water from the Great Lakes Basin in the past, governments could still decide not to allow new and additional sales or diversions in the future.

- The NAFTA and WTO agreements contain provisions that prohibit export restrictions and discrimination between nationals and foreigners who are entitled to national treatment under those treaties. Sales of water that are allowed could not be restricted to the domestic market unless they fit within the health and conserva-

tion exceptions referred to above (i.e., restrictive measures would be necessary for the protection of human, animal, or plant life or health or for the conservation of an exhaustible natural resource and are not applied in a way that constitutes arbitrary or unjustifiable discrimination or a disguised restriction of international trade). Recent decisions of the appellate body of the WTO may raise concerns about the circumstances in which environmental measures will meet the test of not constituting arbitrary or unjustifiable discrimination or a disguised restriction of international trade, even though they may otherwise relate to the conservation of an exhaustible natural resource or may be necessary for the protection of life or health. The WTO decisions have tended to focus on whether measures are arbitrary or discriminatory. In the light of these decisions, it appears that it would be desirable, whenever possible, for environmental measures to be based on an international agreement or arrangement.

- If governments in Canada and the United States want to avoid falling within the investment provisions of the NAFTA, they should avoid creating undue expectations by clearly articulating their water-management policies in a fully transparent manner, by acting in a manner that is entirely consistent with their stated policy, and by limiting the time for which authorizations are valid. Moreover, the governments should make it clear that authorizations do not give rise to any continuing entitlement or expectation on the part of the holder of the authorization, that, if the holder of the authorization were to reapply after the expiry of the authorization, there is no guarantee that that person would be given treatment any more favorable than any other person who might apply, and that it is within the government's jurisdiction to decide whether or not even to permit an authorization to be issued again.

- Actions with respect to water diversions or sales that nationalize or expropriate an investment of a foreigner may lead to a claim under Chapter 11 of NAFTA, which gives private investors of one country the right to commence proceedings against another country for injuries to the rights accorded private investors under the agreement. In all other cases, claims under the WTO agreements or the NAFTA must be brought by a Party to the agreement (i.e., by the government of one of the countries).

Other experts, while not suggesting international trade law made it impossible to regulate exports of water, cautioned that trade law could make the process more complicated.

The Domestic Legal Context

In Canada. The constitutional underpinnings of Canadian water law are found in the Constitution Act. Because water is not treated explicitly in that act, the respective federal and provincial roles in water management can be found under a number of constitutional headings that may be either legislative or proprietary in nature.

Federal legislative jurisdiction over water is rooted in several headings under the Constitution Act. The most obvious are the specific federal responsibilities for navigation and shipping and for sea coast and inland fisheries. Other headings, such as trade and commerce, Indians and lands reserved for Indians, agriculture (a power exercised concurrently with the provinces), criminal law (especially with respect to pollution), and undertakings (including canals) connecting or extending beyond the limits of a province, are also relevant. Two other more general grants of legislative authority are also relevant. The first general grant is the power of the federal government to implement treaties concluded by the British Empire on Canada's behalf. This power supports the International Boundary Waters Treaty Act, but it has not been extended to treaties concluded by Canada in its own right. The second general grant is the power to make laws for the "peace, order and good government" of Canada. Although this power has had a checkered history, it has been used to justify federal authority over marine dumping within provincial waters, and it could take on significance with respect to issues such as climate change that are determined to have a primarily national or international character.

On November 22, 1999, the Minister of Foreign Affairs introduced in the House of Commons proposed amendments to the International Boundary Waters Treaty Act that, if enacted, will impose a prohibition on removals of boundary waters from their water basins. The proposed amendments also provide that the Governor in Council, on the recommendation of the Minister of Foreign Affairs, may make regulations that create exceptions to this prohibition. Moreover, the amendments will require persons to obtain a license from the Minister of Foreign Affairs for

the use, obstruction, or diversion of boundary waters in a manner that in any way affects, or is likely to affect, the natural level or flow of boundary waters on the other side of the international boundary. This licensing requirement does not, however, apply to the ordinary use of waters for domestic or sanitary purposes or in cases for which exceptions have been established by regulations.

According to the Canadian government, the recently introduced amendments to the International Boundary Waters Treaty Act are part of its three-part strategy, announced on February 10, 1999, to prohibit the removal of water (including removals for the purposes of export) out of major Canadian water basins. The strategy includes the joint Reference by Canada and the United States to the International Joint Commission on consumptive uses, diversion, and removal of Great Lakes water. It also includes an effort by the Canadian Minister of the Environment to seek the endorsement by provinces and territories of a Canada-wide accord prohibiting bulk water removals to ensure that all of Canada's watersheds are protected. This process continues.

Apart from its legislative powers, the federal government also exercises certain proprietary rights that may involve a water-management role. These rights include ownership of specified public works such as canals (and connected lands and water power), public harbors, lighthouses and piers, river and lake improvements, lands set apart for general public purposes, and national parks.

Although the federal government exercises jurisdiction over water management primarily through its legislative authority under the Constitution Act, provinces also derive important authority from their proprietary rights. The Constitution Act provides, with limited exceptions, for provincial ownership of all public lands (including water). The legislative powers of the provinces largely buttress their proprietary powers and include authority with respect to management and sale of public lands, local works and undertakings, property and civil rights in the province, and generally all matters of a local or private nature.

There is no plenary federal legislation with respect to water. Historically, the primary interest of the federal government in water management has been focused on its constitutional responsibilities for fisheries (through the Fisheries Act), navigation (through the Navigable Waters Protection Act), and international relations, although it has in recent years taken a role in water quality, particularly with respect to toxic substances.

The most ambitious attempt by the federal government to legislate in a comprehensive fashion with respect to water was the Canada Water Act of 1970. The act emphasizes federal-provincial cooperation and includes provisions for unilateral federal action on transboundary issues. In practice, however, the federal role envisaged in the act has not been fully realized. The International Rivers Improvements Act also has potential application to some water withdrawals with transboundary aspects. The act requires a license for international river improvements. The definition of an international river is very broad and would include, for example, a transboundary water pipeline.

The International Rivers Improvement Act is, however, subject to two important exceptions: It does not apply to improvements situated within boundary waters as defined by the Boundary Waters Treaty, nor does it apply to improvements "constructed, operated or maintained solely for domestic, sanitary or irrigation purposes, or other similar consumptive uses." In sum, as with other federal legislation, the act is not designed to provide a general mechanism for dealing with water removals, and it would not even apply to schemes that do not involve a physical "work" of some kind.

The Ontario Water Resources Act (OWRA) prohibits the withdrawal of more than 50,000 liters (13,209 gal.) of water a day from a well or from surface waters without a permit. Ontario's recently issued Water Taking and Transfer regulation, which took effect on April 30, 1999, among other things, prohibits the transfer of water out of the Great Lakes Basin, subject to certain exceptions.

In Quebec, the Civil Code contains provisions concerning the use of water, including the rights of riparian owners. Moreover, Quebec's Environmental Quality Act, which is concerned primarily with contamination and withdrawals that have a significant effect on the environment, imposes constraints on the use of water.

The Quebec Minister of the Environment introduced Bill 73 on October 21, 1999, in the Quebec National Assembly,

and it was assented to on November 26, 1999. The bill, a proposal for a Water Resources Preservation Act, was put forward as an interim measure to prevent adverse effects on the environment from water transfers outside Quebec prior to completion of the public inquiry that is now underway regarding a framework for water management. The Water Resources Preservation Act prohibits the transfer outside Quebec of surface or groundwater taken in Quebec. Bill 73 does, however, provide exceptions for (1) water to produce electric power, (2) water to be marketed for human consumption that is packaged in Quebec in containers of 20 liters or less, (3) water to supply potable water to establishments or dwellings situated "in a bordering zone," and (4) water to supply vehicles. Moreover, the government may lift the prohibition on the grounds of urgency, for humanitarian reasons, or for any other reason considered to be in the public interest.

In the United States. Congress has plenary power under the commerce clause of the U.S. Constitution to regulate interstate commerce. This federal authority includes the power to authorize and control the diversion of water from one navigable waterway to another or from one watershed to another, and it also includes the power to authorize the use of water for navigational purposes. The exercise of this Congressional power is as broad as the needs of commerce. It extends to the use of water of a navigable stream for the production of hydroelectric power and to the protection of navigable waters from obstruction by out-of-basin diversions and from pollution.

The Great Lakes Basin Compact, which was agreed to by the eight Great Lakes states and approved by the U.S. Congress in 1968 and which created the Great Lakes Commission, provides, among other things, for joint or cooperative action to promote the orderly, integrated, and comprehensive development, use, and conservation of the water resources of the Great Lakes Basin and to plan for the welfare and development of these water resources.

The Water Resources Development Act of 1986 (WRDA) is a federal law that prohibits any further diversion of water from any U.S. portion of the Great Lakes or their tributaries for use outside the Basin unless such diversion is approved by the governors of all Great Lakes states. It also prohibits federal studies of diversions without the concurrence of the governors. The impetus for the Charter and for WRDA was the concern in the U.S. portion of the Great Lakes Basin, in the early 1980s, that there would be major demands for Great Lakes Basin water from the agricultural and energy sectors of the western and southern United States.

The Commission received legal advice on issues related to the Commerce Clause of the U.S. Constitution.

- Under the Supreme Court doctrine known as the Dormant Commerce Clause Doctrine, federal courts may invalidate state laws that either blatantly discriminate against interstate commerce or unreasonably burden interstate commerce in other ways. Courts have consistently applied this doctrine to invalidate state legislation that simply blocks the flow of goods across state lines. On the other hand, they have also recognized that there are times—for example, times of shortage—when a state may favor its own citizens. There are also times when legitimate state interests may justify actions by states that do affect interstate commerce. The more narrowly tailored any restraints on commercialization can be, and the more targeted to preservation of ecological integrity, the more likely the restraints are to be sustained against a Commerce Clause attack. How a court will act in any given case will, of course, depend on the facts of that case.

- The Commission is not aware of any cases where the doctrine has been applied to waters allocated by the doctrine of riparian rights, as are the Great Lakes in the United States, or to interstate or boundary waters widely shared among basin states and a foreign nation. Moreover, Congress has the power to authorize state legislation that would otherwise violate the Dormant Commerce Clause Doctrine, and neither the Court nor commentators have suggested any limitations on this power that would restrain Congressional approval of Great Lakes protection efforts. It is very clear under the Commerce Clause cases that, where Congress has authorized a restraint on trade, there is no Commerce Clause problem.

- The Water Resources Development Act of 1986, by not having standards, may run afoul of the nondelegation doctrine. The U.S. Supreme Court has not, however, found an improper delegation since 1935, and the Water Resources Development Act of 1986 could be upheld by the Court finding appropriate standards

in a variety of sources, such as practice and existing arrangements, including the Great Lakes Charter. This issue could be addressed by the creation of appropriate standards that were legally binding on the states.

Historically, surface water law in each of the Great Lakes states has been based on the doctrine of riparian rights. Under this doctrine, the right to make reasonable use of water in rivers and lakes was incidental to the ownership of land that abutted the water. Leaving aside the relevant provisions of the Boundary Waters Treaty, this right could be exercised even if it caused some diminution in the quantity or quality of the water remaining in the river or lake. The riparian right was usually limited to the use of the water on the riparian land and within the watershed of origin. Traditionally, the use of groundwater was not similarly restricted. Each of the Great Lakes states has made legislative changes to the legal regime over many years, to address specific needs in that state. Changes range from collecting information regarding specific large uses to requiring permits for withdrawals or consumptive uses above a certain amount. Although there is no clear pattern to these legislative changes, they do provide different approaches to achieve overall state water-management goals within a context of riparian rights.

With the signing of the Great Lakes Charter, each of the Great Lakes states found it necessary to institute a legal regime for protecting the Great Lakes ecosystem. Different states have adopted different statutes. Most state laws deal with water withdrawals in general or with withdrawals in the context of Basin waters. Typically, the level of withdrawal that triggers state permitting requirements is well below that which triggers review under the Great Lakes Charter. Although some Basin states (Minnesota, New York, and Wisconsin) include a statutory provision that specifically requires consultations with the other Great Lakes states and provinces in the event of diversions from the Basin that fall within the Charter's trigger provision of 5 million gallons (19 million liters) per day, others have not provided for this explicitly.

Since the signing of the Great Lakes Charter and the adoption of the Water Resources Development Act, several proposals for diversions of Great Lakes water have been considered by the Great Lakes governors and premiers. These proposals include diversions at Pleasant Prairie, Wisconsin, and at Akron, Ohio, which were approved, and at Lowell, Indiana, which was denied. A proposal to divert water from the Crandon Mine to the Wisconsin River was retracted without formal consideration by the Great Lakes governors. A proposal to withdraw water from Lake Huron for the Mud Creek irrigation district in Michigan, an increased consumptive use, went forward even though there were objections by some Great Lakes jurisdictions. To date, the Mud Creek irrigation project has been the only consumptive use proposal large enough to trigger the Charter requirement for notice, consultation, and seeking the concurrence of all Great Lakes Basin jurisdictions. Consequently, the Charter has not yet provided the impetus for an ongoing conversation among the jurisdictions on the subject of consumptive uses.

The implementing resolutions for the Great Lakes Charter that were approved by the Great Lakes governors and premiers in 1987 outlined a review process for diversion proposals. A process has evolved for reviewing and approving diversions pursuant to the Charter and the WRDA. A custom and usage has developed of requiring extensive information before a diversion proposal can be approved. The states have also developed the practice of employing the Charter procedures regarding consultation for diversion proposals covered by WRDA that do not meet the Charter trigger point, so that the provinces are consulted although they have no rights under WRDA.

The Commission notes that while WRDA offers the strength of mandatory review of all proposed diversions, concern has been expressed by observers that WRDA applies only to diversions in the United States, does not address consumptive use, contains no criteria for the governors to use in considering proposals, contains no appeal procedure, and may not cover groundwater.

Legislation was introduced in the U.S. Congress in 1999 to impose a moratorium on the export of water from the U.S. portion of the Great Lakes and, in one case, from elsewhere in the United States pending the development of agreed principles and procedures that would protect the water resources of the Great Lakes Basin. To date, there has not been final Congressional action on these legislative initiatives.

Aboriginal Peoples and Indian Tribes

In Canada, Aboriginal and treaty rights are recognized and affirmed by the Constitution Act, 1982, although the specific nature and the extent of these rights have not yet been determined. Aboriginal Peoples' interests in land are understood to be communal in nature, involving rights of occupation as well as the use and benefit of resources. The extent to which Aboriginal Peoples' interests extend to water and waterways may vary significantly with the circumstances, including whether the particular interest has the status of a treaty right. It is not clearly settled whether Aboriginal Peoples' interests in water are riparian in nature. More generally, however, the federal government may have an obligation to consult with Aboriginal Peoples, which is underpinned by its fiduciary duty toward them.

In the United States, the right of Indian tribes to the use of the waters of the Great Lakes Basin has continued without significant challenge since the reservations were established (late 1700s to the mid-1800s). Although litigation has occurred regarding the existence and extent of tribal fishing rights in the Great Lakes, there does not appear to have been any dispute over tribal use of water from the Great Lakes or its tributaries flowing through or adjacent to the reservations.

During its recent hearings, the Commission received numerous submissions with respect to the interest and involvement of Aboriginal Peoples and Indian tribes. These submissions uniformly expressed opposition to exports or diversions from the Great Lakes Basin and strongly urged the need to ensure opportunities for the participation of Aboriginal Peoples and Indian tribes in decisions concerning the waters of the Great Lakes Basin ecosystem.

During its hearings, the Commission was also requested to clarify the relationship between international trade agreements and treaties with Aboriginal Peoples and Indian tribes. The Commission is not, however, the appropriate forum in which to address this issue.

Next Steps

The Reference asks the Commission to report on additional work that may be required to better understand the implications of consumption, diversions, and removal of water—including removals for export from boundary waters outside the Great Lakes Basin, removals of waters of transboundary basins, and removals of groundwater of shared aquifers—and to prepare a plan proposing the phasing of such additional work.

The Commission's binational, interdisciplinary study team undertook a reconnaissance survey of shared watersheds beyond the Great Lakes Basin to determine the availability of water supply and consumptive use data and the availability of information on such matters as diversions and other removals, bilateral agreements and arrangements with respect to water quantity and quality issues, groundwater, and climate change. Based on this survey, the study team identified the following areas of study in which further work could assist in better understanding the implications of consumption, diversions, and removal of water. It was, however, recognized that these areas of study may not be applicable in the same way to all transboundary basins and that other issues may also deserve attention in some basins.

Water Supply and Consumptive Uses

- Reviews should be undertaken of balances between water supply and consumptive use in major transboundary river basins.
- Transboundary basins in which water shortages may become a constraint on the health of the economy or the environment should be identified.
- Analyses should be undertaken of factors that change balances between water supply and consumptive use in transboundary basins.

Diversions and Other Removals

- The existence of inventories of diversions, other bulk removals, removals for bottling, and exchanges of treated drinking water between border communities should be confirmed.
- Assessments should be undertaken of the probability of future proposals for diversions, other bulk removals, additional removals for bottling, and exchanges for domestic purposes between border communities.
- Assessments should be undertaken of the implications of existing and potential diversions and other removals on shared groundwater resources, water balances, intangible values (e.g., fish, wildlife, heritage, and recreation), and the rights of Aboriginal Peoples and Indian tribes.
- Continuous monitoring should be maintained of any water removals from either country outside the Great Lakes Basin and assessments should be made of their potential implications in terms of removals from the Basin or other regions.

Anticipated Developments

- Information should be assembled on current and probable future developments that are likely to be influenced by, or to affect, transboundary water removals or water use.

Groundwater

- To the extent possible using existing data, descriptions of groundwater hydrology, quality, and availability in shared basins should be prepared.
- To the extent possible using available data, current groundwater uses in the transboundary region and factors likely to affect those uses in the future should be quantified.
- Medium- and long-term research priorities for groundwater management in the boundary region should be identified.

Climate Change

- Existing climate change studies that may be applicable to relevant transboundary basins should be reviewed.
- Appropriate hydrologic indicators (e.g., changes in mean and extreme flows and in seasonal patterns of runoff) should be developed.
- Estimates should be prepared of potential impacts of climate change on social, economic, and environmental interests in transboundary basins.

Transboundary Legal Regimes

- An assessment should be made of the effects of existing Canada–U.S. agreements on water uses and diversions in shared river basins and on the sustainable use of shared water resources.
- An assessment should be made of the effects of federal, provincial, and state legal regimes on water uses and diversions in shared river basins and on the sustainable use of shared water resources.
- An assessment should be made of the effects of interstate, interprovincial, and state–provincial water-management arrangements on water uses and diversions in shared river basins and on the sustainable use of shared water resources.

Binational Institutions and Arrangements

- Binational institutions and arrangements for water management in transboundary basins should be identified.
- An assessment should be made of the adequacy of existing institutions and arrangements in the light of the findings under the headings above.
- Situations in which there may be a need in the future to contemplate new or altered binational water-apportionment arrangements should be identified.

Synthesis

- A synthesis should be prepared of findings in the above areas to provide governments with a broad understanding of the implications of consumption and of diversions and other removals in or from boundary and transboundary surface water and groundwater.
- Policy and legal concerns that the governments should consider addressing should be identified.

The Commission has consulted states and provinces along the border about the plans for additional work on consumption, diversions, and removal of waters from boundary waters outside the Great Lakes Basin, transboundary waters, and shared aquifers. In general, jurisdictions appreciate the importance of these issues and appear to be prepared to share existing information with the Commission. There were, however, different views about how these issues should be addressed.

All western states expressed an interest in cooperating with the Commission on the study. In some of the Canadian provinces, however, there was some concern that encompassing all boundary and transboundary basins and shared aquifers in one sea-to-sea approach could, in some cases, lead to an inappropriate linking of issues.

Manitoba supports the study and would like to participate in such a new or extended Reference. Moreover, Manitoba officials consider that the Commission could be of assistance in resolving binational water quantity issues that are on the horizon, including the apportionment of water crossing the Manitoba–North Dakota portion of the border. North Dakota also considers that the Commission could play a useful role in this area.

Alberta and Saskatchewan officials expressed a number of concerns about the proposed study. In their view, water quantity issues are well in hand in their areas, and they consider that a new or extended Reference would not only duplicate work that is being done by the Alberta and Saskatchewan governments, but would also confuse the public. Moreover, they expressed concern that there could be inappropriate comparisons (e.g., comparisons between

eastern and western situations); that local issues could become linked, making them more difficult to manage and resolve; and that a broad-brush study could reopen old wounds for no apparent reason.

In the east, the Commission consulted with officials from New Hampshire, Vermont, and New Brunswick. There was a general feeling among the participants that all major issues in the boundary region were being addressed appropriately. In addition, budgets throughout the region were extremely tight. Nevertheless, all three jurisdictions were willing to contribute data and information and participate in Commission work under the current reference to the extent that resources were available.

The Commission considers that further work in the areas the study team identified could provide a better understanding of the implications of consumption, diversions, and removal of water from boundary waters outside the Great Lakes Basin, from waters of transboundary basins, and from groundwater of shared aquifers. Taking into account the views it has received, the Commission believes that some issues—such as climate change and groundwater research—should be addressed across the entire border region, and other issues—such as water balances in the plains region and water apportionment in the border region between Manitoba and North Dakota—should be focused at the regional level.

This approach would allow efforts and resources to be focused on important concerns with respect to consumption, diversions, and removal of water in the border region without duplicating work that is being done in states and provinces. This would provide for work to continue binationally, focusing on those priority issues that are not being addressed elsewhere and on specific regional issues to which the Commission can contribute binational experience and resources. In both instances, the Commission's involvement would serve its traditional purpose of acting impartially in the common interest of both countries to prevent and resolve differences.

Section 10

Conclusions

The Commission was charged to provide recommendations to the governments concerning the protection of the waters of the Great Lakes. In the course of developing these recommendations, conducting its studies, and consulting with the public, the Commission was able to draw several conclusions and to note matters it believes should be brought to the attention of the governments at this time. The Commission was also able to identify and build upon principles that would effectively lead to both the protection and the enhancement of the Great Lakes ecosystem.

The Great Lakes Basin Ecosystem

1. The Great Lakes: A Critical Resource. Water is a critical resource that is essential for all forms of life and for a broad range of economic and social activities. The Great Lakes, sometimes referred to as North America's inland sea, are one of the largest freshwater ecosystems in the world and support about 40 million people and a diversity of biotic populations. Moreover, the lakes are a central feature of the natural and cultural heritage of the Great Lakes region and the social and economic interdependence of eight U.S. states and two Canadian provinces.

2. The Aquatic Ecosystem. The Great Lakes aquatic ecosystem is made up not only of the lakes themselves, but also of the complex network of tributaries and groundwater on which the lakes depend. Changes to the lakes, the tributaries, or the groundwater can alter the balance of the ecosystem of the region in significant and sometimes unpredictable ways. Measures aimed at protecting and conserving the waters of the Great Lakes must cover the surface water of the lakes, connecting channels, tributaries, and groundwater if they are to be effective.

3. Conservation. Conservation measures can and should minimize the amount of water that is withdrawn and consumed in the Great Lakes Basin, and such measures must form part of any effort to preserve the integrity of the waters of the Great Lakes Basin and ensure the sustainability of those resources.

4. System Stress. Removals of water from the Great Lakes Basin reduce the resilience of the system and its capacity to cope with future, unpredictable stresses. On an average annual basis, less than 1 percent of the water in the Great Lakes system—approximately 613 billion liters per day (162 billion gallons per day)—is renewable. Any water taken from the system has to be replaced in order to restore the system's lost resilience. It is not possible at this time to identify with any confidence all the adverse consequences of water removals so that these consequences could be mitigated. The precautionary approach dictates that removals should not be authorized unless it can be shown, with confidence, that they will not adversely affect the integrity of the Great Lakes Basin ecosystem.

5. Climate Influences. Although the outflows from Lake Ontario and Lake Superior are regulated, the levels of the lakes ultimately depend on climatic conditions that cannot be controlled or even reliably predicted. It can, however, be expected that the Great Lakes system will continue to experience periods of high and low precipitation and therefore high and low levels and variable flows, which will be beneficial to some interests and disruptive to others. As illustrated during

1998-99—when the level of Lakes Michigan-Huron dropped 57 cm (22 in.) in 12 months—water levels can change quickly over short periods in response to climate conditions.

6. Use of Great Lakes Water. If all interests in the Basin are considered, there is never a "surplus" of water in the Great Lakes system; every drop of water has several potential uses, and trade-offs must be made when, through human intervention, waters are removed from the system. Environmental interests, for example, require fluctuations between high and low levels to preserve diversity. Seemingly "wasted", the infrequent very high waters do, in fact, serve a purpose by inundating less frequently wetted areas and renewing habitat for their biotic occupants. Major outflows from the Great Lakes provide needed freshwater input to fish populations as far away as the Gulf of Maine.

7. Water Quality and Water Quantity. Water quantity and water quality are inextricably linked. For most uses, quantity alone does not satisfy the demand. Since the signing of the Great Lakes Water Quality Agreement, significant strides have been made toward restoring and preserving the quality of water in the Great Lakes Basin. However, in many areas, the restoration has not been complete and problems remain. In these situations, this poor water quality impairs the potential uses of the waters of the Great Lakes and constitutes a virtual "removal" of usable waters from the system.

8. Climate Change. Mounting evidence of the potential for climate change adds uncertainty to the nature of future supplies to the Great Lakes and how the levels and flows of the lakes will be affected. All climate models to date agree that there will be some increase in temperature in North America. Although most models suggest that global warming would lower Great Lakes levels and outflows, there is some limited new information that suggests the possibility of a slight rise in water levels. There is information to suggest that there could be more frequent and severe local weather events. Climate change also has the potential to increase the demand for water, both inside and outside the Great Lakes Basin.

9. Future Demands. There is uncertainty not only with respect to water supplies to the Great Lakes Basin, but also with respect to future demand for water within the Basin. The use of water for irrigation is increasing in the Basin. Currently, however, there is a trend to slower growth in water withdrawals in the Great Lakes region. This trend is the result of conservation and environmental measures, shifts in resources from the industrial sector to the service sector, and a decline in population growth, mainly in the portion of the Basin that lies within the United States. Whether this trend will continue cannot be predicted. Existing water use data, much of which is out of date, do not provide a reliable basis from which to predict future demand, and withdrawals could start to rise again with economic growth or climate change.

10. Diversions and Other Removals. Over the longer term, a number of factors may affect the demand for water diversions and other bulk removals. Global population growth or climate changes could result in requests for shipments of Great Lakes water to meet short-term humanitarian needs. Geography and distance may reduce such demands as there are more logical and more economical water sources closer to most areas of potential drought. The United Nations advocates that the solution to future water crises rests with nations learning to use water more efficiently, not in shipping freshwater around the world.

11. Potential Diversions. There are no active proposals for major diversion projects either into or out of the Basin at the present time. There is little reason to believe that such projects will become economically, environmentally, and socially feasible in the foreseeable future. Although the Commission has not identified any planning for or consideration of major diversions in areas outside the Basin, such diversions cannot be entirely discounted. There are no active proposals for any smaller diversions into or out of the Great Lakes Basin at this time, although growth trends would indicate that such requests are likely from communities on or near the Great Lakes Basin divide.

12. Interruptions of Supply. Apart from the many engineering, economic, environmental, and social obstacles to construction of large-scale diversions, and given the variations in water levels and flows in the Great Lakes, it would be impossible for the Great Lakes jurisdictions to guarantee an uninterruptible supply to any mega-removal. Some interests in the Great Lakes Basin, such as riparian homeowners, might welcome a means of removing water from the Basin during periods of extremely high levels. Most interests, including in-stream interests, commercial navigation,

and recreational boating, would be adamantly opposed to such removals in periods of low levels. Diversions during droughts would be difficult to interrupt because of the dependency that diversions create among recipients. The Commission recognizes that once a diversion to a water-poor area is permitted, it would be very difficult to shut it off at some time in the future.

13. Current Bulk Removals. There are not, at present, significant removals of water from the Great Lakes Basin by truck. There is no trade in water from the Great Lakes by marine tanker, although the Nova Group in 1998 did seek a permit to ship 600 million liters (159 million gallons) of water annually from Lake Superior to Asia. Moreover, despite the increase that has occurred in the market for bottled water, the volume of water leaving the Great Lakes Basin in bottles is not significant (the amount of bottled water presently imported into the Basin exceeds the amount leaving by a factor of 14). The amount of ballast water currently leaving the Basin is not sufficient to cause damage to the Basin ecosystem. There is nevertheless a need to monitor these activities and keep them under review.

14. Groundwater. There is uncertainty and a lack of adequate data about groundwater and use of groundwater in the Basin. Data on withdrawals vary in quality, while data on consumption are extremely limited. It is estimated that about 5 percent of all withdrawals in the Basin are from groundwater. Current estimates of consumption of groundwater do not indicate that this consumption is a major factor with respect to Great Lakes levels. Nevertheless, it is a matter of considerable importance to more than 20 percent of the Basin's human population and to the large biological community that rely on groundwater and that can be significantly affected by local withdrawals. There is a serious lack of information on groundwater in the Basin, and governments should undertake the necessary research to meet this need. There is clear need for state, provincial, and local government attention to the monitoring and regulation of groundwater withdrawals and protection of groundwater recharge areas.

15. Human Interventions. Human activities beyond water removals and consumption have had impacts on the natural environment of the Great Lakes ecosystem. Land use changes, water pollution, regulation of lake levels, channel work for navigation, construction of dams, other activities, and development of wetlands can affect water levels, destroy habitat, and modify hydrologic regimes.

Great Lakes Basin Laws and Policies

16. Cooperative Efforts. The Great Lakes Basin extends across the boundary between Canada and the United States and the borders of eight states and of the provinces of Ontario and Quebec. None of these governments alone can regulate water in the entire Basin. The Great Lakes are an integrated hydrologic system. When water is removed from the Basin on one side of the international boundary by either consumptive use or removals, the amount of water that is available on both sides is reduced. Measures to protect and conserve the waters of the Great Lakes ecosystem must therefore be directed at the Basin as a whole in order to be effective. This requires cooperation and coordination among the governments with responsibilities in the Basin.

17. The Boundary Waters Treaty

- At the international level, the waters of the Great Lakes are subject to the requirements of the Boundary Waters Treaty, which has established a binational regime that has been in place since 1909. The treaty requires, among other things, a special agreement between the governments of Canada and the United States or approval of the International Joint Commission for uses of boundary waters that affect levels or flows on the other side of the border. It also provides that each country reserves exclusive jurisdiction and control over tributaries of boundary waters.

- The Boundary Waters Treaty, after 90 years, continues to provide effective protection for both countries from abuses to the waters of the Great Lakes Basin ecosystem. It represents a proven regime for avoiding and resolving disputes that arise between Canada and the United States over boundary waters and transboundary rivers.

- The Boundary Waters Treaty is buttressed by the Great Lakes Water Quality Agreement, which the governments of Canada and the United States signed in 1978. The objective of that agreement is to protect the

physical, chemical, and biological integrity of the waters of the Great Lakes Basin ecosystem.

18. The Dormant Commerce Clause Doctrine. In the United States, the Dormant Commerce Clause Doctrine could be a constitutional restraint on state efforts, as opposed to federal efforts, to protect the resources of the Great Lakes. However, it need not prevent genuine, well-supported cooperative management and conservation and cooperation among the Great Lakes states and provinces. The potential restraint is reduced considerably if the states can agree on common standards for the use and protection of Great Lakes waters and can coordinate their water-management programs with federal and binational efforts.

19. Great Lakes Charter.

- The Great Lakes Charter is an effective arrangement among the Great Lakes states and the provinces of Ontario and Quebec. Although it is not legally binding, the Charter fosters cooperation among the states and provinces on water resource issues and requires that the states and provinces notify each other of major new or increased diversions or consumptive use.

- The Great Lakes Charter's trigger amount for consideration of significant proposed new diversions and consumptive use is too high to encourage the degree of consultation regarding the use of Great Lakes water that is needed to assure the sustainable use of these resources.

- The Charter does not require the consent of all Great Lakes states and provinces before allowing a new diversion or consumptive use to proceed, it does not establish standards for when such consent should be given or withheld, and it does not provide for public involvement during the consultation process.

20. Conservation Management. Conservation of water by using it more efficiently makes sound economic and environmental sense. Little has been done by the states and provinces to implement the conservation provisions of the Great Lakes Basin Water Resources Management Program, to which they are committed under the Great Lakes Charter. The states and provinces need to make a commitment to move forward vigorously with conservation programs.

21. Data Monitoring and Collection. Sound management of the water resources of the Great Lakes requires sound data about these resources. Although the Great Lakes Charter provides a structure for the collection, analysis, and distribution of these data, progress in the data management area has been very slow. The states and provinces have failed to maintain adequate databases needed to make appropriate decisions concerning the management of the waters of the Great Lakes Basin. In addition, current monitoring arrangements are inadequate to support such decisions and to assess cumulative effects of water use. The federal governments, the Great Lakes states, and the provinces are underfunding data collection and management and, as a result, must use outdated and inadequate information in their decision-making process. This calls into question the soundness of governments' decisions. The uncertainty of future water supply makes adequate data collection and management an absolute necessity.

22. Legal Limitations. There are now laws in both countries that, in different ways, limit removals of water from the Great Lakes Basin. These laws, however, apply only in the jurisdictions that enacted them; they can be changed by those jurisdictions at any time and do not constitute a binational regime.

23. Trade Law. International trade law obligations—including the provisions of the Canada–United States Free Trade Agreement (FTA), the North American Free Trade Agreement (NAFTA), and World Trade Organization (WTO) agreements, including the General Agreement on Tariffs and Trade (GATT)—do not prevent Canada and the United States from taking measures to protect their water resources and preserve the integrity of the Great Lakes Basin ecosystem. Such measures are not prohibited so long as there is no discrimination by decision makers against persons from other countries in their application, and so long as water management policies are clearly articulated and consistently implemented so that undue expectations are not created. Canada and the United States cannot be compelled by trade laws to endanger the waters of the Great Lakes ecosystem. The public, however, remains deeply concerned that international trade law could affect the protection of these waters.

Principles

24. To ensure the protection and conservation of the waters of the Great Lakes, the Commission concludes that the following principles should guide their management:

Integrity of the Ecosystem: The Great Lakes Basin is an integrated and fragile ecosystem. Its surface and groundwater resources are part of a single hydrologic system and should be dealt with as a unified whole in ways that take into account water quantity, water quality, and ecosystem integrity.

The Precautionary Approach: Because there is uncertainty about the availability of Great Lakes water in the future—in the light of previous variations in climatic conditions as well as potential climate change, uncertainty about the demands that may be placed on that water, uncertainty about the reliability of existing data, and uncertainty about the extent to which removals and consumptive use harm, perhaps irreparably, the integrity of the Basin ecosystem—caution should be used in managing water to protect the resource for the future. There should be a bias in favor of retaining water in the system and using it more efficiently and effectively.

Sustainability: Water and related resources of the Basin should be used and managed to meet present needs, while not foreclosing options for future generations to meet their cultural, economic, environmental, and social needs.

Water Conservation: There should be an obligation to apply the best conservation and demand-management practices to reduce water use and consumptive losses and thus retain water in the Basin.

Cooperation: Decisions regarding management of water resources must involve cooperation among the two federal governments, the Great Lakes states and provinces, the tribes and Aboriginal Peoples, the municipalities and regions, and the citizenry on both sides of the boundary. The processes must be open to involvement and meaningful participation by these governments, the stakeholders, and the public.

Existing Institutions: Existing institutions, processes, and legal instruments—including the Boundary Waters Treaty, the International Joint Commission, the Great Lakes Charter, the U.S. Water Resources Development Act, the Ontario Water Taking and Transfer Regulation, and the Great Lakes Commission—have provided vehicles to deal with water use issues. It is important to retain these strengths in any new process. Moreover, it is important to continue to respect existing international agreements and arrangements and the rights of tribes and Aboriginal Peoples.

Measurable Objectives, Sound Science, and Adaptive Management: Water resource goals should, whenever possible, be established as measurable objectives that can be assessed through open, objective, scientific studies that are subject to peer review. Where information is incomplete, particularly with respect to emerging issues of concern, decisions should be based on the precautionary approach and should take into account the best available data, information, and knowledge, including cultural, economic, environmental, and social values.

Fairness: The Great Lakes Basin community is broad, diverse, and interdependent. Culturally and economically, it extends beyond the physical confines of the hydrologic basin. It is important that programs designed to protect the ecological foundation of the Basin community be, and be seen to be, fair to all those who use and contribute to the Basin and are part of the community.

Recommendations

The following recommendations build upon the Boundary Waters Treaty, which provides the principles and mechanisms to help prevent and resolve disputes (primarily those concerning water quantity and water quality along the boundary between Canada and the United States), and upon the Great Lakes Charter, which brings together the Great Lakes states and provinces in a cooperative arrangement designed to protect the Great Lakes. They were developed in accordance with the ecosystem approach adopted by the governments of Canada and the United States in the Great Lakes Water Quality Agreement, the purpose of which is to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin ecosystem. The Commission's recommendations have also been prepared to support and enhance the economic and social well-being of the Great Lakes Basin community and to ensure that the beneficial uses associated with ecosystem integrity are sustained over the long term.

Recommendation I. Removals

Without prejudice to the authority of the federal governments of the United States and Canada, the governments of the Great Lakes states and Ontario and Quebec should not permit any proposal for removal of water from the Great Lakes Basin to proceed unless the proponent can demonstrate that the removal would not endanger the integrity of the ecosystem of the Great Lakes Basin and that:

a. there are no practical alternatives for obtaining the water,
b. full consideration has been given to the potential cumulative impacts of the proposed removal, taking into account the possibility of similar proposals in the foreseeable future,
c. effective conservation practices will be implemented in the place to which the water would be sent,
d. sound planning practices will be applied with respect to the proposed removal, and
e. there is no net loss to the area from which the water is taken and, in any event, there is no greater than a 5 percent loss (the average loss of all consumptive uses within the Great Lakes Basin); and the water is returned in a condition that, using the best available technology, protects the quality of and prevents the introduction of alien invasive species into the waters of the Great Lakes.

In reviewing proposals for removals of water from the Great Lakes to near-Basin communities, consideration should be given to the possible interrelationships between aquifers and ecosystems in the requesting communities and aquifers and ecosystems in the Great Lakes Basin.

In implementing this recommendation, states and provinces shall ensure that the quality of all water returned meets the objectives of the Great Lakes Water Quality Agreement.

At this time, removal from the Basin of water that is used for ballast or that is in containers of 20 liters or less should be considered, prima facie, not to endanger the integrity of the ecosystem of the Great Lakes. However, caution should be taken to properly assess the possible significant local impacts of removals in containers.

Removal of water for short-term humanitarian purposes should be exempt from the above restrictions.

The governments of Canada and the United States and the governments of the Great Lakes states and Ontario and Quebec should notify each other of any proposals for the removal of water from the Great Lakes Basin, except for removal of water that is used for ballast or that is in containers of 20 liters or less.

Consultations regarding proposed removals should continue in accordance with the procedures and processes that are evolving throughout the Great Lakes Basin and should be coupled with additional opportunities for public involvement.

Any transboundary disagreements concerning any of the above matters that the affected governments are not able to resolve may, as appropriate, be referred by the governments of Canada or the United States to the International Joint Commission pursuant to Article IX of the Boundary Waters Treaty.

Nothing in this recommendation alters rights or obligations under the Boundary Waters Treaty.

Recommendation II. Major New or Increased Consumptive Uses

To avoid endangering the integrity of the ecosystem of the Great Lakes Basin, and without prejudice to the authority of the federal governments of the United States and Canada, the governments of the Great Lakes states and Ontario and Quebec should not permit any proposal for major new or increased consumptive use of water from the Great Lakes Basin to proceed unless:

a. full consideration has been given to the potential cumulative impacts of the proposed new or increased major consumptive use, taking into account the possibility of similar proposals in the foreseeable future,
b. effective conservation practices will be implemented in the requesting area, and
c. sound planning practices will be applied with respect to the proposed consumptive use.

In implementing this recommendation, states and provinces shall ensure that the quality of all water returned meets the objectives of the Great Lakes Water Quality Agreement.

The governments of Canada and the United States and the governments of the Great Lakes states and Ontario and Quebec should notify each other of any proposals for major new or increased consumptive uses of water from the Great Lakes Basin.

Consultations regarding proposed major new or increased consumptive uses should continue in accordance with the procedures and processes that are evolving throughout the Great Lakes Basin and should be coupled with additional opportunities for public involvement.

Any transboundary disagreements concerning the above that the affected governments are not able to resolve may, as appropriate, be referred by the governments of Canada or the United States to the International Joint Commission pursuant to Article IX of the Boundary Waters Treaty.

Nothing in this recommendation alters rights or obligations under the Boundary Waters Treaty.

Recommendation III. Conservation

In order to avoid endangering the integrity of the ecosystem of the Great Lakes Basin, the governments of the Great Lakes states and Ontario and Quebec should apply conservation measures to significantly improve efficiencies in the use of water in the Great Lakes Basin and should implement the conservation measures set out in this recommendation.

The governments of the Great Lakes states and Ontario and Quebec, in collaboration with local authorities, should develop and launch a coordinated basin-wide water conservation initiative, with quantified consumption reduction targets, specific target dates, and monitoring of the achievement of targets, to protect the integrity of the Great Lakes Basin ecosystem, and to take advantage of the other economic and environmental benefits that normally flow from such measures.

In developing and implementing this initiative, the governments should, among other things, consider:

a. state-of-the-art conservation and pollution-control technologies and practices,
b. potential cumulative impacts,
c. the application of sound planning practices,
d. to the extent practicable, the setting of water prices at a level that will encourage conservation,
e. conditioning financial help from governments for water and wastewater infrastructure on the application of sound conservation practices,
f. promotion of eco-efficient practices, especially in the industrial and agricultural sectors,
g. establishment of effective leak detection and repair programs for water infrastructure in all municipalities,
h. the inclusion of strong performance and environmental standards and financial incentives for water saving in contractual arrangements for delivery of water-related services, whether public or private,
i. the application of best practicable water-saving technologies in governmental facilities,
j. sharing experiences with respect to the planning and implementation of conservation policies and programs and the use of water-saving technologies, and
k. joint preparation of promotional and educational materials and publication of success stories, including sponsoring conferences and workshops on water conservation, in partnership with others.

Recommendation IV. Great Lakes Charter Standards

Without prejudice to the authority of the federal governments of the United States and Canada, the Great Lakes States and Ontario and Quebec, in carrying out their responsibilities under the Great Lakes Charter, should develop, within 24 months, with full public involvement and in an open process, the standards and the procedures, including the standards and the procedures in Recommendations I and II, that would be used to make decisions concerning removals or major new or increased consumptive uses. Federal, state, and provincial governments should not authorize or permit any new removals and should exercise caution with respect to major new or increased consumptive use until such standards have been promulgated or until 24 months have passed, whichever comes first.

Recommendation V. Existing Institutions and Mechanisms

To help ensure the effective, cooperative, and timely implementation of programs for the sustainable use of the water resources of the Great Lakes Basin, governments should use and build on existing institutions to implement the recommendations of this report. In this regard, the governments of the states and the provinces should take action, with respect to the implementation of the Great Lakes Charter, to:

a. develop and implement, on an urgent basis, the Basin Water Resources Management Program,
b. develop a broader range of consultation procedures than is currently called for in the Charter to assure that significant effects of proposed uses of water resources in the Great Lakes Basin are assessed, and
c. ensure that the notice and consultation process under the Charter is open and transparent and that there is adequate consultation with the public.

Recommendation VI. Data and Research

Federal, state, and provincial governments should move quickly to remedy water use data deficiencies by:

a. allocating sufficient staff and financial resources to upgrade the timeliness, precision, and accuracy of water use data,
b. working much closer together to ensure consistency in water use monitoring, estimation techniques, and reporting,
c. emphasizing and supporting the development and maintenance of a common base of data and information regarding the use and management of the water resources of the Great Lakes Basin, establishing systematic arrangements for the exchange of water data and information, and undertaking coordinated research efforts to provide improved information for future water planning and management decisions.

Furthermore, governments should immediately take steps to ensure that, on a binational basis, research is coordinated on individual and cumulative impacts of water withdrawals on the integrity of the Great Lakes Basin ecosystem. In support of their decision-making, governments should implement long-term monitoring programs capable

of detecting threats (including cumulative threats) to ecosystem integrity. Such monitoring programs should be comprehensive, particularly in their approaches to detecting threats to ecosystem integrity at a spectrum of space and time scales.

As part of an anticipatory policy for identifying emerging issues, governments should, on a binational basis, undertake more active science and research and, in particular, should implement appropriate long-term monitoring programs for key indicators of ecosystem change.

Recommendation VII. Groundwater

Governments should immediately take steps to enhance groundwater research in order to better understand the role of groundwater in the Great Lakes Basin. In particular, they should conduct research related to:

a. unified, consistent mapping of boundary and transboundary hydrogeological units,
b. a comprehensive description of the role of groundwater in supporting ecological systems,
c. improved estimates that reliably reflect the true level and extent of consumptive use,
d. simplified methods of identifying large groundwater withdrawals near boundaries of hydrologic basins, effects of land-use changes and population growth on
e. groundwater availability and quality,
f. groundwater discharge to surface water streams and to the Great Lakes, and systematic estimation of natural recharge areas, and
g. systematic monitoring and tracking of the use of water-taking permits, especially for bottled water operations.

In recognition of the frequent and pervasive interaction between groundwater and surface water and the virtual impossibility of distinguishing between them in some instances, governments should apply the precautionary principle with respect to removals and consumptive use of groundwater in the Basin.

Recommendation VIII. Climate Change

Recognizing that the Intergovernmental Panel on Climate Change has concluded that human activities are having a discernible effect on global climate, and despite the uncertainties associated with the modeling of future climate, the governments of Canada and the United States should fully implement their international commitments to reduce greenhouse gas emissions.

Recommendation IX. Trade Law

The governments of the United States and Canada should direct more effort to allaying the public's concern that international trade law obligations could prevent Canada and the United States from taking measures to protect waters in the boundary region, and they also need to direct more effort to bringing greater clarity and consensus to the issue.

Recommendation X. Standing Reference

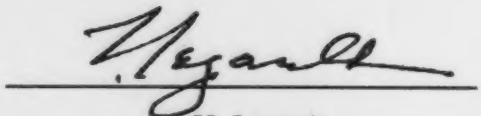
The Commission should be given a standing reference to review its recommendations for the protection of the waters of the Great Lakes in three years and thereafter at 10-year intervals unless conditions dictate a more frequent review.

Recommendation XI. Next Steps

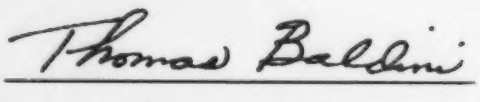
The Commission recommends that the governments consider for adoption the proposed plan of work for Commission activities on the rest of the border, focusing on priority issues and on specific regional issues where the Commission can contribute binational experience and resources.

Recommendation XII. Implementation

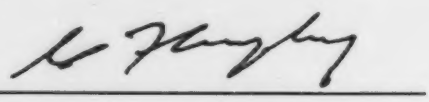
The Commission recommends that the governments of the United States and Canada and the governments of the Great Lakes states and Ontario and Quebec, acting individually or collectively, as appropriate, take the necessary steps to implement the recommendations contained in this report.



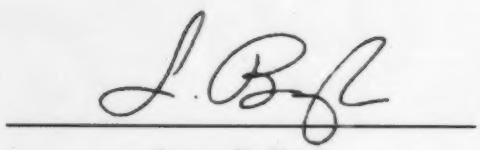
L. H. Legault
Canadian Chairman



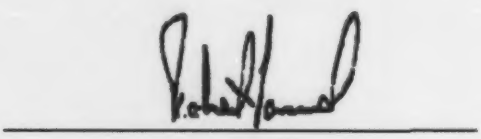
Thomas L. Baldini
United States Chairman



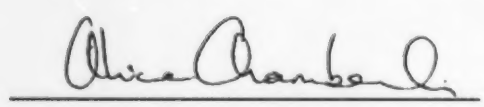
C. Francis Murphy
Commissioner



Susan B. Bayh
Commissioner



Robert Gourd
Commissioner



Alice Chamberlin
Commissioner

Appendix 1

Letter of Reference

I have the honor to inform you the Governments of the United States and Canada have agreed, pursuant to Article IX of the Boundary Waters Treaty of 1909, to request the Commission to examine into and report upon matters concerning the use of waters along our common border.

Recently, a proposal to export water by tanker from Lake Superior arose. The Governments are concerned that individual projects of apparently minor effect will set a precedent of bulk removal of water from the Great Lakes basin, opening the Great Lakes and other water bodies to subsequent water removal initiatives, with unpredictable consequences. The bulk removal of water raises serious concern over cumulative impacts on lakes, rivers and other water sources.

Boundary water resources continue to be the subject of ever-increasing demands in the light of expanding populations. Proposals to use, divert and remove greater amounts of such waters can be expected.

The Governments are concerned that current management principles and conservation measures may be inadequate to ensure the future sustainable use of our shared waters.

The Commission is requested to examine, report upon, and provide recommendations as the Commission deems appropriate on the following matters which have, or may have, effects on levels and flows of waters within the boundary or transboundary basins and shared aquifers:

a) Existing and potential consumptive uses of water;
b) Existing and potential diversions of water in and out of the transboundary basins, including withdrawals of water for export;
c) The cumulative effects of existing and potential diversions, andremovals of water, including removals in bulk for export;
d) The current laws and policies as may affect the sustainability of the water resources in boundary and transboundary basins.

The Governments note that extensive research has already been conducted about the Great Lakes, in particular, the Commission's January 1985 report "Great Lakes Diversions and Consumptive Uses". The Governments believe that the Commission's 1985 Report with respect to the Great Lakes, including Lake Michigan, provides a good basis on which to begin the study. In the light of this existing body of knowledge pertaining to the Great Lakes, as well as the urgency of this issue precipitated by export proposals, the Governments request that the Commission give first priority to an examination of the Great Lakes basin, focussing on the potential effects of bulk water removal, including removals for export and provide interim recommendations for the protection of the waters of the Great Lakes, as can be developed from available data, in six months from February 10, 1999.

The Governments further request that the Commission subsequently complete other work on the Great Lakes as may be needed. The Commission is asked to submit its final report on the Great Lakes at the latest six months after the interim report.

In its final report on the Great Lakes, the Commission is further requested to report on additional work that may be required to better understand the implications of consumption, diversions and removal of water, including removals for export from other boundary waters, waters of transboundary basins, and groundwater of shared aquifers. In this regard, the Commission is asked to prepare a plan proposing the phasing of such additional work.

In preparing recommendations, the Commission shall consider in general terms such matters as potential effects on the environment and other interests of diversions and consumptive uses and where appropriate, the implications of climatological trends and conditions.

In the conduct of its investigation and the preparation of its report, the Commission shall have use of information and technical data available to the Governments and that may become available to the Governments during the course of its investigations. In addition, the Commission shall seek the assistance, as required, of specifically qualified personnel in the two countries.

The Governments shall seek in equal shares the funds required to provide the Commission with the resources needed to discharge the obligations under the reference. The Commission shall develop, as early as practicable, cost projecting for the studies under reference, for the information of the Governments.

An identical letter is being sent to the Secretary of the Canadian Section of the Commission by the Department of Foreign Affairs and International Trade.

An identical letter is being sent to the Secretary of the US Section of the Commission by State Department.

Appendix 2

Study Team

CANADIAN MEMBERS

Mr. Ralph Pentland
Co-Director, Canada
Consultant

Mr. Douglas Cuthbert
Water Issues Division
Environment Canada

Mr. Richard Kellow
Executive Director
Transboundary Waters Unit
Prairie and Northern Region
Environment Canada

Mr. Raymond Perrier
Environnement et développement durable ltée,
Vaudreuil, Québec

Mr. J. Owen Saunders
Executive Director
Canadian Institute of Resources Law
The University of Calgary

Ms. Paula Thompson
Lands & Natural Heritage Branch
Ministry of Natural Resources, Ontario

U.S. MEMBERS

Colonel James Hougnon
Co-Director, United States
U.S. Army Corps of
Engineers

Ms. Shannon E. Cunniff
Bureau of Reclamation
Department of Interior

Dr. Michael J. Donahue
Executive Director
Great Lakes Commission

Ms. Margaret Grant
Executive Director
Council of Great Lakes Governors

(Alternate: Mr. Jeffrey Edstrom)

Mr. Gary N. Paulachok
Water Resources Division
U.S. Geological Survey

Mr. Anthony G. Willardson
Associate Director
Western States Water Council

Dr. Frank J. Quinn
Special Adviser to the Study Team

IJC Study Participants

CANADIAN SECTION

Dr. Murray Clamen
Secretary

Ms. Valerie Brunette
Executive Assistant

Mr. Anthony Clarke
Senior Environment Adviser

Mr. Fabien Lengellé
Public Affairs Adviser

Mr. Michael Vechsler
Legal Adviser

U.S. SECTION

Dr. Gerry Galloway
Secretary

Mr. Bruce Bandurski
Ecomanagement Adviser

Mr. Tom Callow
Senior Adviser

Mr. James Chandler
Legal Adviser

Dr. Joel Fisher
Environmental Adviser

Ms. Soo Han
Special Assistant

Edalin Michael
Intern

Appendix 3

Schedule of Public Hearings

Round One

March 17, 1999
Cleveland, Ohio

March 17, 1999
Montréal, Québec

March 18, 1999
Chicago, Illinois

March 18, 1999
Toronto, Ontario

March 22, 1999
Sault Ste. Marie, Ontario

March 23, 1999
Windsor, Ontario

March 24, 1999
Duluth, Minnesota

March 25, 1999
Rochester, New York

Round Two

September 26, 1999
Milwaukee, Wisconsin

October 5, 1999
London, Ontario

October 12, 1999
Detroit, Michigan

October 12, 1999
Toronto, Ontario

October 13, 1999
Ottawa, Ontario

October 14, 1999
Washington, DC

October 19, 1999
Sault Ste. Marie, Ontario

October 19, 1999
Gary, Indiana

October 20, 1999
Buffalo, New York

October 20, 1999
Duluth, Minnesota

October 21, 1999
Thunder Bay, Ontario

October 21, 1999
Montréal, Québec

Appendix 4

Expert Input and Public Testimony

The Commission wishes to thank everyone who wrote letters or cards, sent e-mails, and appeared at the public hearings. All the comments were reviewed carefully. The Commission would also like to acknowledge contributions by the following:

General

Mr. André Delisle, Transfert Environnement, Québec

Mr. Benjamin Felzer, Climate Scenarios Coordinator for the U.S. National Assessment on Potential Consequences of Climate Variability and Change

Mr. James R. Karr, Professor of Fisheries and Zoology, University of Washington, Seattle, WA

Professor Kevin Kennedy, Detroit College of Law, Michigan State University

Dr. Gordon McBean, Assistant Deputy Minister, Atmospheric Environment Service, Environment Canada

Dr. Andrew Moore, Policy Analyst, Council of Great Lakes Governors

Ms. Linda Mortsch, Climate Impacts and Adaptation Researcher, Adaptation and Impacts Research Group, Environment Canada

Dr. Frank Quinn, Senior Research Hydrologist, Great Lakes Environmental Research Laboratory, NOAA

Dr. Peter Rogers, Professor, Gordon McKay Professor of Environmental Engineering and City Planning, Harvard University

Dr. Michael A. Rozengurt, Coastal Consulting, Inc., Huntington Beach, CA

Dr. David W. Schindler, Department of Biological Sciences, University of Alberta

Mr. Wayne B. Solley, Chief, Branch of WaterUse Information, U.S. Department of the Interior, U.S. Geological Survey

Dr. Peter Sousounis, Great Lakes Region Assessment Program Director, U.S. National Assessment, University of Michigan

Mr. Guy Tremblay, Transfert Environnement, Québec

Report To The Council of the Great Lakes Governors on Governing the Withdrawal of Water from the Great Lakes, May 18, 1999.

Workshop on Cumulative Impacts
Windsor, Ontario – September 29-30, 1999

Mr. Robert Boulden, Boulden Environmental Consulting, Ottawa

Mr. James Bruce, Senior Associate, Global Change Strategies International Inc., Ottawa

Dr. Thomas Coon, Department of Fisheries and Wildlife, Michigan State University

Mr. Norman Grannimann, U.S. Geological Survey

Mr. John Hall, Canadian Department of Fisheries and Oceans Fish & Wildlife Habitat Restoration

Dr. Andrew Hamilton, Commission for Environmental Cooperation, Montréal

Ms. Erica Hieber, Biologist, Institute for Water Research

Dr. Henry Regier, Professor Emeritus, University of Toronto

Dr. Ronald Rossman, Grosse Île Research Station, U.S. Environmental Protection Agency

Dr. Michel Slivitzky, Professor Emeritus, INRSEAU, SaintRaymond, Québec

Mr. William Werick, Institute for Water Research, US Army Corps of Engineers

Mr. Doug Wilcox, Great Lakes Science Center, U.S. Geological Survey

Education Session on Consumption, Diversion, and Removal of Water
Windsor Ontario – February 25-26, 1999

Professor Ben Dziegielewski, University of Southern Illinois

Mr. Thomas Edsall, Branch Chief, Western Basin Ecosystems, Biological Resources Division, US Geological Survey

Mr. Jeffrey E. Edstrom, Senior Policy Director, Council of Great Lakes Governors

Mr. John Johnson, Partner, Goodman Phillips & Vineberg, Toronto

Mr. David LeMarquand, Secretary, IJC Red River Task Force, Ottawa
Mr. James R. Nicholas, Michigan District Chief, Water Resources Division, US Geological Survey
Dr. Donald Tate, GAIA Economic Research Associates, Ottawa
Mr. Harvey Thorliefson, Geological Survey of Canada
Professor Marcia Valiante, Faculty of Law, University of Windsor
Mr. Doug Wilcox, Great Lakes Science Center, U.S. Geological Survey
Professor Sandra Zellmer, University of Toledo College of Law, & Legal Institute of the Great Lakes

Expert's Policy Workshop
Toronto, Ontario – March 30-31, 1999

Mr. PaulÉmile Barbeau, Président, Aquaroute, Québec
Mr. James Bruce, Senior Associate, Global Change Strategies International Inc., Ottawa
Mr. Ric Davidge, Alaska Water Exports, Anchorage, Alaska
Mr. Dean Jacobs, Executive Director, Walpole Island Heritage Centre, Wallaceburg, Ontario
Dr. Ronald Loucks, Loucks Oceanology Ltd., Halifax
Ms. Sarah Miller, Canadian Environmental Law Association, Toronto
Dr. Peter Pearse, Consultant, Vancouver
Professor Joseph Sax, University of California at Berkeley Law School
Mr. A. Dan Tarlock, Professor of Law, ChicagoKent School of Law
Mr. Richard Wahl, Consultant, Boulder, Colorado
Dr. Gilbert F. White, National Hazards Research & Applications Center, University of Colorado at Boulder

Meeting with British Columbia Representatives
Victoria, British Columbia – October 29, 1999

Mr. Don Fast, Assistant Deputy Minister. Ministry of the Environment, Lands and Parks
Mr. Les MacLaren, Crown Corporations Secretariat, Energy Crowns
Mr. Bruce Morgan, Corporate Policy Branch, Ministry of Environment, Lands and Parks
Ms. Shelley Murphy, Electricity Development Branch, Ministry of Employment and Investment
Mr. Keith Ogilvie, International Relations, Intergovernmental Relations Secretariat
Mr. Noel Schacter, International Branch, Ministry of Employment and Investment
Mr. Dan Thachuk, International Branch, Ministry of Employment and Investment

Meeting with Prairie Provinces Water Board
Edmonton, Alberta – November 1, 1999

Mr. Ron Bothe, Water Management Division, Alberta Environment
Mr. Wayne Dylwig, Water Resource and Infrastructure Management, Saskatchewan Water Corporation
Mr. Steve Topping, Water Resources Branch, Manitoba Natural Resources
Mr. Jim Vollmershausen, Regional Director General, Prairie and Northern Region, Environment Canada
Mr. Bob Wettlaufer, Director, Regional Operations, Prairie Farm Rehabilitation Administration, Regina

Meeting with Western States Representatives
Spokane, Washington – November 18, 1999

Mr. Larry Dolan, State of Montana Department of Natural Resources and Conservation
Mr. John Dunker, State of Alaska Department of Natural Resources
Mr. Christopher Estes, State of Alaska Department of Natural Resources
Mr. Tony Grover, Washington Department of Ecology
Mr. Bob Haynes, State of Idaho Water Resources
Mr. Rich Moy, State of Montana Department of Natural Resources and Conservation
Mr. Gary Prokosch, State of Alaska Department of Natural Resources

Mr. Francis Schwindt, State of North Dakota Department of Natural Resources
Mr. David Sprynczynatyk, North Dakota State Engineer
Mr. Rob Swedo, Bonneville Power Administration, State of Washington
Mr. Tony Willardson, Western States Water Council

Meeting with Eastern States Representatives
Concord, New Hampshire – December 2, 1999

Mr. Canute Dalmasse, Commissioner of Environmental Conservation of Vermont
Ms. Jane Keenan, New Brunswick Department of the Environment
Mr. Harry Steward, State of New Hampshire Department of Environmental Services

Panelists at Public Hearings
(Listed in Order of Appearance)

Ottawa, Ontario – October 13, 1999

Panel 1 International Trade:

Professor Don McRae, University of Ottawa
Mr. Chris Thomas, International Trade Lawyer, Vancouver

Washington, DC – October 14, 1999

Panel 1 Trade and International Commerce:

Professor Raj Bhala, George Washington University Law School
Mr. Doug J. Caldwell, National Wildlife Federation
Ms. L. Brennan VanDyke, Legislative Assistant, Office of Senator Carl Levin
Mr. James S. Lochhead, Attorney at Law, Brownstein Hyatt & Farber, P.C., Denver, Colorado
Professor A. Dan Tarlock, ChicagoKent College of Law & Consultant to the Council of Great Lakes Governors

Panel 2 Environmental and Economic Organizations:

Ms. Allegra Cangelosi, Director, Congressional Great Lakes Task Force, NortheastMidwest Institute
Ms. Jeanne Christie, Associate Director, Association of State Wetland Managers
Mr. Jack Sullivan, Deputy Executive Director for Government Affairs, American Water Works Association
Ms. Cathy Rose, Great Lakes Ecosystem Program, Sierra Club

Panel 3 Environmental and Economic Organizations:

Mr. Craig H. Middlebrook, Chief of Staff, St. Lawrence Seaway Development Corporation
Mr. Dan Berical, Vice PresidentPolicy and Government Affairs, New York Power Authority

Gary, Indiana – October 19, 1999

Panel 1:

Mr. Dan Injerd, State of Illinois Department of Natural Resources
Ms. Irene Brooks, Commonwealth of Pennsylvania Department of Environmental Protection
Mr. Dick Bartz, State of Ohio, Department of Natural Resources
Ms. Adrienne Esparza, State of Indiana Department of Environmental Management
Mr. Steve Davis, State of Indiana, Department of Natural Resources

Panel 2:

Dr. Steve Foreman, Professor of Geophysics, University of Illinois at Chicago
Mr. Henry Henderson, Senior Fellow, Great Cities Institute, University of Illinois at Chicago

Buffalo, New York – October 20, 1999

Panel 1:

Professor Barry Boyer, University of Buffalo School of Law
Professor Joseph Delapenna, Villanova University School of Law

Panel 2:

Mr. Richard Toby, Commissioner, Erie County Department of Environment and Planning
Mr. George Hasiotos, Commissioner, Erie County Water Authority
Mr. Michael McGlinchy, Division Manager, Public Utilities, City of Akron, Ohio

Elected Officials and Government Representatives at Public Hearings (Listed in Order of Appearance)

Cleveland, Ohio – March 17, 1999

Government Representatives:

Elizabeth Thames, Office of Congressman Sherrod Brown (Ohio)
Richard Bartz, State of Ohio Department of Natural Resources
Bob Wysenski, Assistant District Chief, State of Ohio Environmental Protection Agency

Montréal, Québec – March 17, 1999

Government Representative:

Christiane Hudon, Environment Canada

Chicago, Illinois – March 18, 1999

Elected Officials:

Congressman Bart Stupak (Michigan)
Mary Ann Smith, Alderman48th Ward, City of Chicago, Illinois

Government Representative:

Daniel Injerd, State of Illinois Department of Natural Resources

Sault Ste. Marie, Ontario – March 22, 1999

Elected Official:

State Representative Scott Shackleton (Michigan)

Windsor, Ontario – March 23, 1999

Elected Official:

Rick LaLiberte, MP, Churchill River, Saskatchewan

Duluth, Minnesota – March 24, 1999

Government Representative:

Kent Lokkesmoe, State of Minnesota Department of Natural Resources

Rochester, New York – March 25, 1999

Government Representatives:

Sean T. Hanna, Monroe County Legislature
Mike Garland, Office of Monroe County Executive Jack Doyle
John Hood, Erie County Department of Environment and Planning

Milwaukee, Wisconsin – September 26, 1999

Government Representative:

Eric Christiansen, Wisconsin Coastal Management Council (Representing State of Wisconsin and Department of Natural Resources)

Detroit, Michigan – October 12, 1999

Government Representative:

G. Tracy Meehan, Director, Office of the Great Lakes, Michigan Department of Environmental Quality (Representing Governor Engler)

Ottawa, Ontario – October 13, 1999

Government Representative:

Anne Charles, Department of Foreign Affairs and International Trade

Washington, DC – October 14, 1999

Elected Officials:

Senator Carl Levin (Michigan)
Senator Mike DeWine (Ohio)
Representative David Camp (Michigan)
Representative Dennis J. Kucinich (Ohio)
Representative Steven C. LaTourette (Ohio)
Representative Sherrod Brown (Ohio)
Representative Bart Stupak (Michigan)
Representative Peter Hoekstra (Michigan)
Representative Louise Slaughter (New York)
Representative Jack Quinn (New York)

Gary, Indiana – October 19, 1999

Government Representative:

Mark Savinski, District Director, Office of Congressman Peter Visclosky (Indiana)

Buffalo, New York October 20, 1999

Elected Official:

Representative Sam Hoyt (New York)

Government Representatives:

Sarah Martin, Office of Representative Tom Reynolds (New York)
Caroline Goodwin, Office of Senator Charles Schumer (New York)
James Smith, Office of Buffalo Mayor Anthony M. Masiello
Chuck Swanek, Chairman, Erie County Legislature

Duluth, Minnesota – October 20, 1999

Elected Officials:

Mayor Larry McDonald of Bayfield, Wisconsin
Mr. David Connolly, Member, Douglas County Elected Board

Government Representative:

James Japs, Manager, Water Appropriation Permit Program, Minnesota Department of Natural Resources

The Commission apologizes in advance to anyone inadvertently left off these lists.

Appendix 5

Glossary of Terms

Consumptive Use: That portion of water withdrawn which is evaporated, transpired from plants, incorporated into products or otherwise lost, and thus is not available for further use in the basin.

Cubic feet per second (cfs): Unit expressing rate of discharge. One cfs is equivalent to one cubic foot of water flowing past a particular point in one second. The flow over Niagara Falls in daylight hours in the tourist season is 100,000 cfs.

Cubic meters per second (cms): Unit expressing rate of discharge. One cms is equivalent to one cubic meter of water flowing past a particular point in one second. The flow over Niagara Falls in daylight hours in the tourist season is 2830 cms. One cms equals 35.315 cfs.

Diversion: Water conveyed by canal, pipeline, modified channel or any similar means from its basin of origin for use in another drainage basin. This usually means interbasin diversion, e.g., Chicago diversion out of, or Ogoki diversion into, the Great Lakes Basin. There may also be diversions between sub-basins called intrabasin diversions, e.g., Welland Canal, diverting water from Lake Erie to Lake Ontario.

Ecosystem Integrity: Capacity of the ecosystem to maintain operations under normal conditions, to cope with external influences, and to continue the dynamic process of self-organization indefinitely.

Ecosystem Resilience: A measurement of the magnitude of disturbance that can be accommodated before the system alters its structure by changing the variables and processes that control system behavior.

Great Lakes Ecosystem: The interacting components of air, land, water and living organisms, including humans, within the Great Lakes Basin.

Net Basin Supply: Net water supply in the Basin resulting from precipitation on the lakes' surfaces, runoff from their tributary drainage areas, groundwater flow into or out of the lakes, and evaporation.

Removal: Water conveyed outside its basin of origin by any means. Bulk removal includes diversions or other means such as tanker ships or trucks which carry water in larger volumes, but excludes water used as ballast in ships or incorporated into products or otherwise bottled for retail sale.

Return Flow (Non-Consumptive Use): The remaining portion of water withdrawn which returns to surface or underground sources after use, and thus becomes available for further use in the Basin.

Sustainable Management: A set of objectives and activities consistent with the purpose of maintaining or improving the integrity of the ecosystem and contributing to the well-being of its living systems, now and in the future.

Withdrawal: Water taken from nature –surface or ground water– for uses such as municipal and industrial.

Appendix 6

Summary of Past Diversion and Removal Proposals

In 1959, private sector interests first proposed the GRAND Canal scheme. This proposal called for a dike to be built across James Bay so that the massive inflows from Ontario and Quebec could be caught and pumped up to the Great Lakes and beyond to drier parts of the continent. The scheme has not overcome criticism of its huge socioeconomic and environmental costs. A number of proposals to draw small quantities of water for coal slurry pipelines, mine de-watering operations and small communities beyond the basin have not proceeded.

The prospect of an expanded diversion at Chicago has concerned other jurisdictions around the Great Lakes for many years. Like other navigable links which preceded the Boundary Waters Treaty of 1909, historic rates of diversion at Chicago were accepted but any expansion beyond the U.S. Supreme Court decreed limit of 3,200 cfs has been resisted. The most recent discussion of increases in the amount of the diversion was initiated, in 1988, by southern Congressmen and the U.S. Army Corps of Engineers. The Corps was asked to consider increasing the diversion to 10,000 cfs as a short-term (1-2 month) emergency means of maintaining barge navigation downstream on the Mississippi during a summer drought. This proposal was shelved after review indicated that the additional flows would have only marginal impact on Mississippi River conditions and that any increased diversions would face strong opposition from Great Lakes jurisdictions.

Various other smaller-scale proposals to divert water from the Great Lakes Basin have been abandoned, in recent years, as a result of increasing opposition by Great Lakes jurisdictions which have worked to create institutions and legislation to regulate this kind of activity.

In Canada, a federal-provincial investigation was started in 1965 into the engineering costs of importing more water from northern Ontario to increase hydroelectric power generation in the Great Lakes Basin. The investigation was terminated in 1974 without reaching a conclusion. At about the same time, the Ontario Water Resources Commission studied taking water to inland communities within the Great Lakes Basin, such as Kitchener-Waterloo and other municipalities in the vicinity of Toronto, through pipelines from Lake Huron, Lake Erie and Lake Ontario. Private and municipal interests have undertaken similar investigations in the present decade but, to date, it has not been shown that local alternatives, including conservation practices, do not provide adequate means for these communities to meet their water needs.

In the early 1970s, the U.S. Army Corps of Engineers completed a review of possible diversions from the Great Lakes to ease the effects of drought in the northeastern states. Twelve years later, in 1982, the Corps report reviewed diversion alternatives to restore groundwater levels in the Ogallala Aquifer under the High Plains. The U. S. Army Corps of Engineers concluded that neither was feasible.

Appendix 7

Exchange of Notes and Article III of the Niagara Treaty of 1950

Exchange of Notes

On October 14, 1940 the United States Secretary of State sent the following Note to the Canadian Minister in Washington:

I have the honor to refer to the conversations which have taken place recently between officials of the Governments of the United States and Canada in regard to the desirability of taking immediate steps looking to the early development of certain portions of the Great Lakes-St. Lawrence Basin project. These conversations have indicated that there is apprehension in both countries over the possibility of a power shortage; these apprehensions have been heightened by the necessity for increased supplies of power in consequence of Canada's war effort and of the major national defense effort in the United States.

In the light of these considerations the Government of the United States proposes that each Government appoint forthwith a Temporary Great Lakes-St. Lawrence Basin Committee consisting of not more than five members. These two Committees would co-operate in preliminary engineering and other investigations for that part of the project which is located in the International Rapids Section of the St. Lawrence River, in order that the entire project may be undertaken without delay when final decision is reached by the two Governments. The Government of the United States is prepared to advance the necessary funds up to $1,000,000 to pay for these preliminary engineering and other investigations, on the understanding that their cost shall ultimately be prorated by agreement between the two Governments.

Meanwhile, to assist in providing an adequate supply of power to meet Canadian defense needs and contingent upon the Province of Ontario's agreeing to provide immediately for diversions into the Great Lakes System of waters from the Albany River Basin which normally flow into Hudson Bay, the Government of the United States will interpose no objection, pending the conclusion of a final Great Lakes-St. Lawrence River Basin agreement for power at Niagara Falls by the Province of Ontario of additional waters equivalent in quantity to the diversions into the Great Lakes Basin above referred to.

I shall be glad if you will let me know if your Government is in accord with the foregoing proposals.

On October 14, 1940 the Canadian Minister in Washington sent Note No. 316 to the United States Secretary of State:

I have the honour to refer to your note of October 14, in which you proposed that the Governments of Canada and the United States take immediate steps looking to the early development of certain portions of the Great Lakes-St. Lawrence Basin project.

I am instructed to inform you that the Canadian Government is in accord with the proposals which you have made.

On October 31, 1940 the Canadian Minister in Washington sent Note No. 340 to the United States Secretary of State:

I have the honour to refer to the third paragraph of your note of October 14, concerning the Great Lakes-St. Laurence Basin project, in which you state that to assist in providing an adequate supply of power to meet Canadian defence needs and contingent upon the Province of Ontario's agreeing to provide immediately for diversions into the Great Lakes System of waters from the Albany River Basin which normally flow into the Hudson Bay, the Government of the United States would interpose no objection, pending the conclusion of a final Great Lakes-St. Laurence Basin agreement between the two countries, to the immediate utilization for power at Niagara Falls by the Province of Ontario of additional waters equivalent in quantity to the diversions into the Great Lakes Basin above referred to.

I am instructed to inform you that the Canadian Government has received appropriate assurances that the Hydro-Electric Power Commission of Ontario is prepared to proceed immediately with the Long Lac-Ogoki diversions and that this action has been approved by the Government of the Province.

The Canadian Government is therefore giving appropriate instructions to authorize the additional diversion of 5,000 cubic feet per second at Niagara by the Hydro-Electric Power Commission of Ontario.

On November 7, 1940 the United States Secretary of State sent the following Note to the Canadian Minister in Washington:

I have the honor to acknowledge the receipt of your Note No. 340 of October 31, 1940, stating that the Hydro-Electric Power Commission of Ontario is prepared to proceed immediately with the Long Lac-Ogoki diversions of waters from the Albany River Basin into the Great Lakes System and that this action has been approved by the Government of the Province.

I note also that the Canadian Government is giving appropriate instructions to authorize the additional diversion of 5,000 cubic feet per second of water at Niagara Falls by the Hydro-Electric Power Commission of Ontario.

The Niagara Treaty of 1950
Article III

The amount of water which shall be available for the purposes included in Articles IV and V of this Treaty shall be the total outflow from Lake Erie to the Welland Canal and the Niagara River (including the Black Rock Canal) less the amount of water used and necessary for domestic and sanitary purposes and for the service of canals for the purposes of navigation. Waters which are being diverted into the natural drainage of the Great Lakes System through the existing Long Lac-Ogoki works shall continue to be governed by the notes exchanged between the Government of the United States of America and the Government of Canada at Washington on October 14 and 31 and November 7, 1940, and shall not be included in the waters allocated under the provisions of this Treaty.

Letter from the Deputy United States Trade Representative (November 24, 1999)

Thank you for sharing the interim findings of the International Commission's (IJC) "Protection of the Waters of the Great Lakes" report and inviting our views on the extent to which the rights and obligations created by international trade agreements apply to water resource management decisions.

First, in the report the IJC issued an interim recommendation that federal, state and provincial governments not authorize or permit any new bulk sales or removals of surface water or groundwater from the Great Lakes Basin. In our view, the implementation of this recommendation would not run afoul of the obligations imposed by international trade agreements to which the United States and Canada are parties.

Second, you asked how international trade law might limit or otherwise affect the ability of the federal, state, or provincial governments to manage the use of surface water and groundwater of the Great Lakes Basin. In response, we offer the following perspective.

There is a long-standing, well-developed body of international law - reflected in thousands of international agreements over literally hundreds of years - on the non-navigational uses of watercourses. Under this body of law, water resource management rights belong to the country or countries where the watercourse flows. We are not aware of any government having challenged this principle in any forum, let alone before an international trade body such as the World Trade Organization.

Indeed, there is no indication in the negotiating history of, or over 50 years of practice in, the General Agreement on Tariffs and Trade and the WTO that governments have ever suggested that international law governing water rights and water management should be modified or superseded in any way through the application of international trade rules. This is hardly surprising given the fact that water resource management issues have been and continue to be addressed through specific water rights treaties between the countries where the watercourses and located.

Given the web of bilateral, regional, and international treaties governing water rights and obligations between WTO member governments, as well as the sovereign interest of all governments in managing the water resources in their territories, we consider it highly improbable that any government would seek to bring international water rights issues before the WTO. Even more extraordinary would be such a claim by a country that has no territorial nexus to the watercourse at issue. Over the past 50 years, there has been no shortage of disputes between governments around the world over water rights claims. Notwithstanding that fact, no government seeking access to water resources controlled by another nation has ever sought to bring the matter before the GATT or the WTO. We do not expect that situation to change.

This is not to say that WTO rules could never apply to water which has been extracted from watercourse and actually traded in international commerce. But the WTO simply has nothing to say regarding the basic decision by governments on whether to permit the extraction of water from lakes and rivers in their territory.

Thank you for providing us with a copy of the Commission's report and for the opportunity to address the question that you raised. We look forward with interest to your final report on this matter.

Bulk Water Removals and International Trade Considerations: Document from the Canadian Department of Foreign Affairs and International Trade

(November 16, 1999)

Introduction

On February 10, the federal government announced a strategy to protect the integrity of Canadian water resources by prohibiting the bulk removal of water from Canadian water basins, including for purposes of export. Canadians are concerned about the long-term security of freshwater and want governments to act to conserve and protect this precious resource. To achieve this objective the federal government has proposed a Canada-wide approach which is environmentally sound, respects the key role played by provinces as the managers of natural resources and is consistent with Canada's international trade obligations. There are three components to this approach:

- a Canada-wide accord between the federal and provincial-territorial levels of government to prohibit the bulk removal of water from Canadian water basins. This would apply to all Canadian waters. The accord will be discussed at the end of November at a meeting of the Canadian Council of Ministers of the Environment (CCME).

- amendments by the federal government to the 1911 International Boundary Waters Treaty Act (IBWTA), which implements the 1909 Canada-U.S. Boundary Waters Treaty. The amendments will give the Minister of Foreign Affairs the authority to prohibit bulk removals from boundary waters. The amendments will be introduced in Parliament soon; and,

- a joint Canada-U.S. reference to the International Joint Commission, the independent, binational agency charged, under the Boundary Waters Treaty, with overseeing boundary waters. The reference concerns the effects of water consumption, diversion and removal, including for export, from boundary waters. The Interim Report (Protection of the Waters of the Great Lakes) was released in August. The final report is due in February 2000.

This comprehensive environmental approach ensures that both the federal and provincial governments will do their part within their jurisdictions to preserve the integrity of the ecosystem within the water basins.

The federal government's strategy is based on a careful analysis of all of the legal, trade and environmental factors, and is well-grounded in policy and law. At the federal level, the amendments to the International Boundary Waters Treaty Act will prohibit the bulk removal of water from boundary waters. The Preliminary Article of the Boundary Waters Treaty defines boundary waters as "...the waters from main shore to main shore of the lakes and rivers and connecting waterways,...", i.e. water is unambiguously defined as in its natural state. The federal government,

through discussions on a Canada-wide accord, will be asking the provinces to take similar measures within their areas of jurisdiction.

In summary, the federal strategy to prohibit bulk removals of water from Canadian water basins is an environmental measure of general application aimed at preserving the integrity of the ecosystem within the water basin. The approach of prohibiting removal of water from its natural state outside of its water basin has been chosen because it is more comprehensive environmentally, it respects provincial jurisdiction, and it is consistent with international trade obligations. An export ban would be a less comprehensive approach as it would not address environmental dimensions (e.g. the prohibition of bulk removal from all Canadian water basins) and may be vulnerable to a trade challenge.

International Trade Considerations

The issue of whether water is subject to international trade agreements, such as the North American Free Trade Agreement (NAFTA) and the World Trade Organization's agreements (WTO), has been raised in some quarters.

This question raises three separate but related issues:

- whether these trade agreements apply to water;
- whether allowing the removal and export of some water creates a precedent, compelling Canada or any province to allow the removal and export of all water; and,
- the relationship between bulk water removal and Chapter 11 of the NAFTA.

1. Water as a Natural Resource; Water as a Good[1]

The NAFTA and the WTO generally prohibit restrictions on the exportation of goods, subject to certain exceptions, none of which are likely to be applicable for present purposes. Therefore, it is necessary to determine whether and when water would be considered a "good" and subject to these trade agreements.

In the absence of a definition of good in the NAFTA or the WTO, recourse may be had to the ordinary meaning of the word "good" as defined, for example, in dictionaries. Based on the ordinary meaning of the word good, that is, something that can be traded for value, or a saleable commodity, water in its natural state is not a good.

Some observers have suggested that, because Canada's (and most other countries') tariff schedule includes "natural waters" as a tariff heading, this means that all water must be considered to be a good. This is a mistaken view of the purpose of the tariff schedule. The tariff schedule does not define what is a good; it merely provides an organizational structure for the purposes of tariff negotiations and customs administration. In other words, it does not tell us if and when water is a good; it only tells us that when water is classified as a good, it falls under a particular tariff heading.

Water in its natural state can be equated with other natural resources, such as trees in the forest, fish in the sea, or minerals in the ground. While all of these things can be transformed into saleable commodities through harvesting or extraction, until that crucial step is taken they remain natural resources and outside the scope of the trade agreements.

The NAFTA countries reinforced this viewpoint in December 1993 when they issued a joint statement, in the context of the NAFTA coming into force, which indicated that "unless water, in any form, has entered into commerce and becomes a good or product, it is not covered by the provisions of any trade agreement, including the NAFTA...Water in its natural state in lakes, rivers, reservoirs, aquifers and the like is not a good or product...".

Furthermore, the International Joint Commission stated in its August 1999 interim report on bulk water removal from the Great Lakes that, "it would appear unlikely that water in its natural state (e.g., in a lake, river, or aquifer) is included within the scope of any of these trade agreements since it is not a product or good...".

1- Trade agreements variously use the terms "good" and "product" and, in the case of the NAFTA, the two are treated as interchangeable. For ease of reading, this document will use the term "good" as indicative of both terms.

Water does not become a good until it is removed from its natural state and enters into commerce as a saleable commodity, such as in bottles or in bulk containers. It would not include water provided by licence, or as a service by municipalities or a province for domestic, industrial and agricultural uses where the charge for such water reflects the cost of supplying it rather than a price for it as a commodity. Even if that water were considered a good, it would only be in respect of that particular water and not water remaining in its natural state. Likewise, the issuance of a licence to withdraw some water for a limited purpose, such as a temporary use, is not sufficient to transform that water into a good. In that situation, it is more accurate to speak of a right of use, rather than a right in goods.

Because water in its natural state is not a good and therefore outside the scope of the trade agreements, the proposed Accord on bulk water removal, and any federal or provincial measure regulating the extraction of water in its natural state, would not be subject to international obligations concerning trade in goods.

2. Exports of Water as a Precedent

A second issue is whether allowing some water to be extracted and put into commerce as a good, including for export, would create a precedent requiring that all other requests to extract water and transform it into a good for commercial purposes, including for export, be granted, anywhere in Canada.

There is nothing in international trade agreements which would require that future projects for the bulk extraction or removal of water, including for export, be approved just because previous bulk water removal projects have been approved. From the standpoint of trade obligations, the fact that a government has allowed the extraction and transformation of some water into a good, including for export, does not mean it (or another government within Canada) must allow the extraction and transformation of other water into a good in the future.

This point is readily illustrated by looking at the fishing industry for a parallel example of a natural resource that can be transformed into a good. In that context, governments have a discretionary power to decide not only whether to allow fishing as a general policy, but also where and when fishing may take place, and the total quantity of fish that may be caught. From the standpoint of trade agreements, that discretion is not affected by previous decisions that allowed some fishing to take place.

3. Bulk Water Removals and NAFTA Chapter 11

Chapter 11 only applies to measures adopted or maintained by a NAFTA country relating to investors, and investments of investors, of another NAFTA country in its territory. It also provides a mechanism for dealing with investor-state disputes relating to a NAFTA country's alleged breach of its obligations under Chapter 11.

The principal obligations of Chapter 11 most often cited as relevant to bulk water removals are:

- providing national treatment; and,
- paying compensation in cases of expropriation.

National Treatment

The national treatment obligation requires that any measure adopted or maintained by Canada relating to an investor, or the investment of an investor, of another NAFTA country, must accord treatment no less favourable than that it accords, in like circumstances, to its own domestic investors and investments.

For example, a regulatory measure relating to an investor, or an investment of an investor, of another NAFTA country, would be consistent with the national treatment obligation if it prohibited the removal of bulk water from water basins in a manner that did not discriminate between investors, in like circumstances, on the basis of nationality. Canada's proposed strategy with respect to the prohibition on bulk water removals from water basins is in keeping with this obligation.

Expropriation and Compensation

The NAFTA provides that the Parties may not nationalize or expropriate an investment of an investor of another Party, either directly or indirectly, or take measures tantamount to expropriation, unless it satisfies certain criteria, including the payment of compensation. A claim for com-

pensation could only arise where there was an investment that had been expropriated. A regulatory measure designed to conserve and manage water resources, if properly implemented, should not constitute an expropriation. Any claim for compensation would have to be examined in light of the details of the individual case.

4. Conclusion

In so far as trade in goods is concerned, the NAFTA and the WTO do not impose disciplines on the ability of governments to regulate the extraction of water from its natural state, nor do they create obligations that would compel Canada or any province to allow the extraction of bulk water, including for export, without any limits. Because the proposed Accord relates to water in its natural state, it would not be subject to the provisions of these trade agreements with respect to trade in goods.

Furthermore, as long as regulations governing the extraction of water from its natural state do not discriminate among NAFTA investors, or investments of investors, in like circumstances, on the basis of nationality, such regulations will be consistent with the national treatment obligation of Chapter 11 of the NAFTA. Also, such measures, if properly implemented, should not constitute an expropriation under the NAFTA.